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Electrical World

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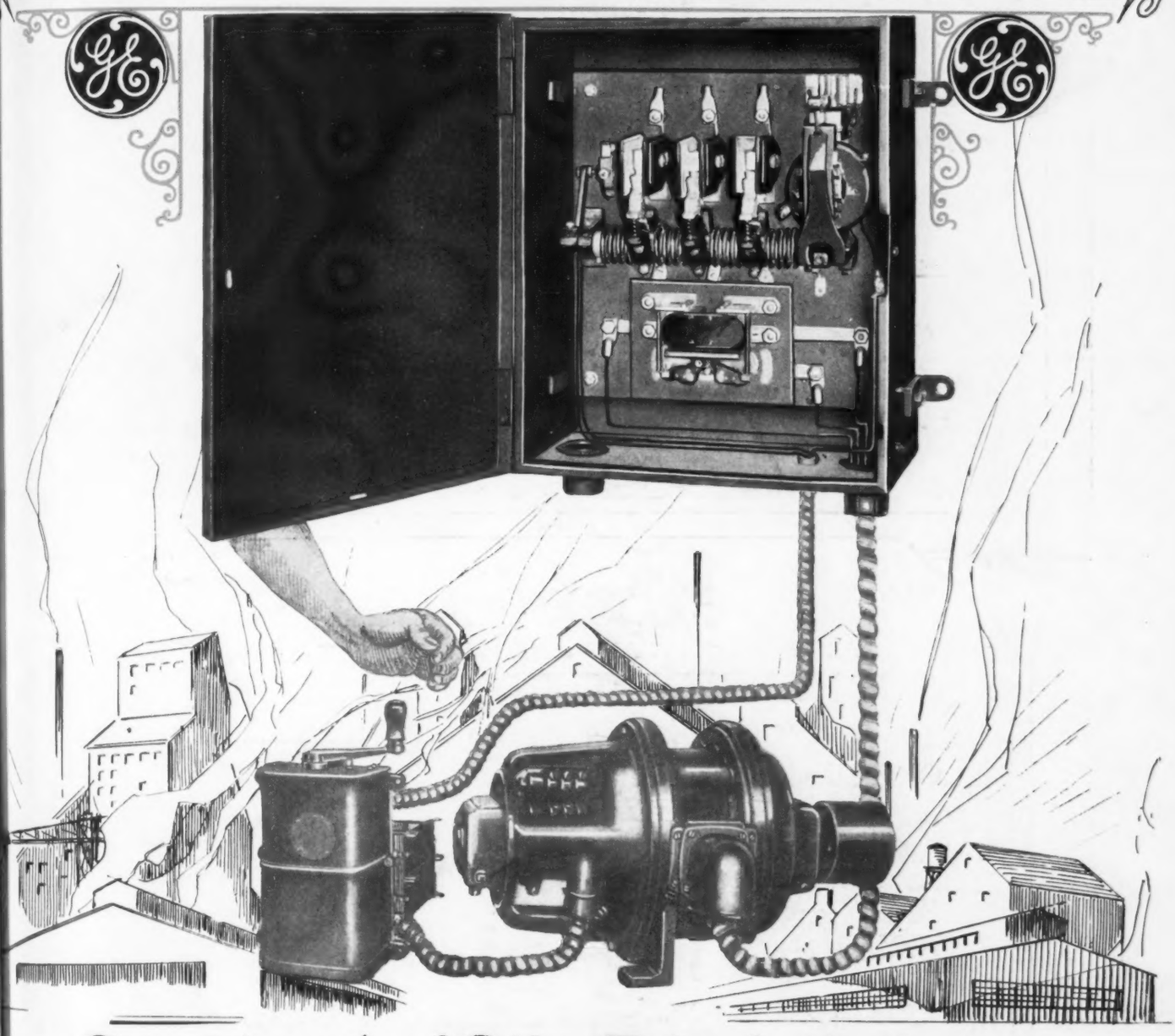

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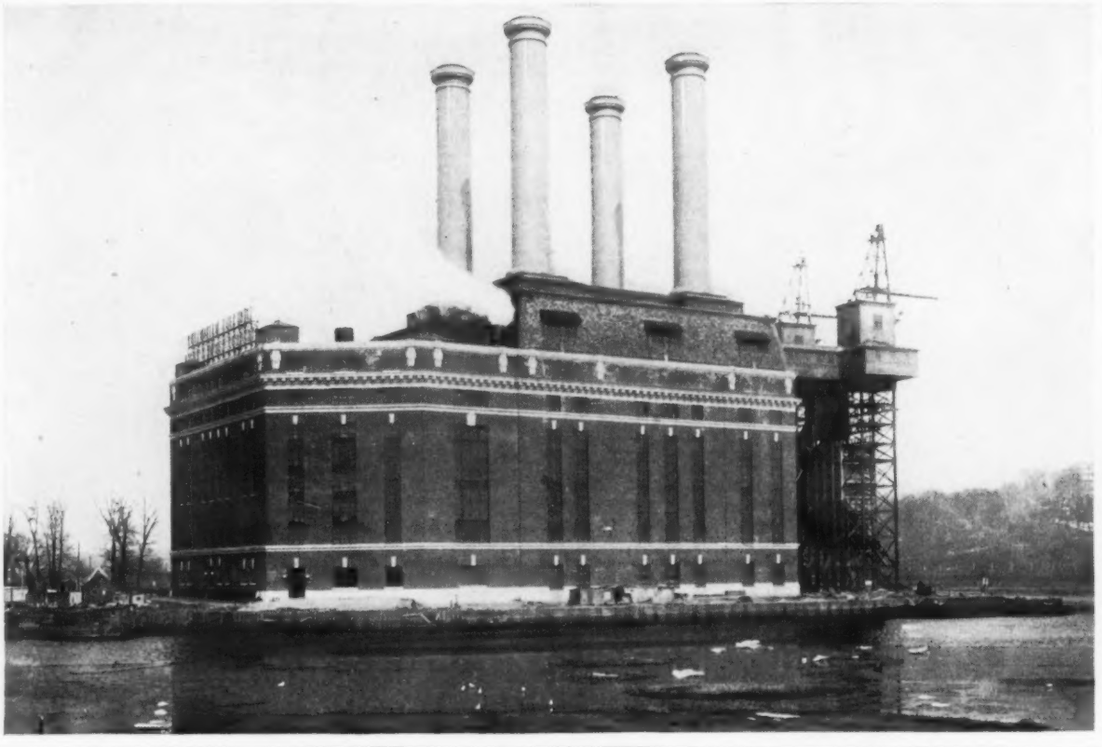

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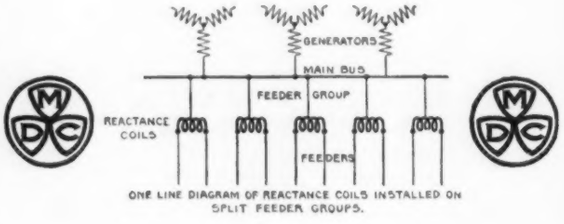
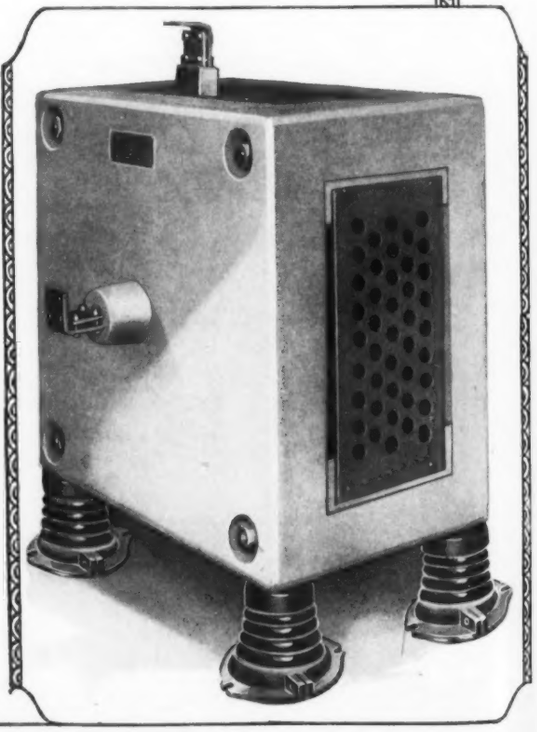


ONE LINE DIAGRAM OF REACTANCE COILS INSTALLED ON SPLIT FEEDER GROUPS.



METROPOLITAN DEVICE CORP.
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Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

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Editor

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Government Ownership with Private Operation

THE great drawback to government ownership and operation is the political pressure and preferment invariably surrounding the enterprise. That this has been a serious handicap is very generally recognized even in governmental circles. To rid governmental enterprises of these handicaps, European nations have either given up ownership in them altogether, as in Italy and Spain, or vested the ownership in a private corporation all the stock of which is owned by the government, as in Austria and Germany. By this means governmentally owned enterprises are supposedly operated like privately owned enterprises and politics in a measure frustrated.

Time alone will reveal whether this form of corporation actually avoids the drawbacks usually associated with government ownership. It has not been found successful in the United States at any rate. Attention is being directed to the enterprises in Europe chiefly through the issuance of bonds in the American market. The abbreviated names by which they are known—as, for example, "Wag" and "Newag" in Austria and "Viag" in Germany—indicate that the Teutons at least appreciate the difficulty of making familiar in foreign markets issues with compounded names almost unpronounceable in one breath! Brevity may possibly prove the soul of popularity in these cases—or, again, it may not.

Prizes in Abundance and of Value

TO INCREASE the interest of employees in the electric light and power industry the National Electric Light Association offers yearly a number of cash prizes. These are awarded for the best papers prepared on subjects relating to the industry, and this year the range of prizes has been considerably broadened and their value increased. In addition to the usual Doherty and Billings prizes there are the Byllesby awards for accounting papers, the James H. McGraw awards for technical papers, the Martin J. Insull award for the best dissertation on public relations and the Arthur Williams award for the best treatise on a commercial subject. There are also available the Frank W. Smith educational prize, the Insull safety medals, the *Forbes Magazine* prize and the employees' lighting education prizes. And now comes the announcement that Bonbright & Company will offer prizes totaling $10,000 for the best essays embodying a five-year historic and a five-year prophetic "review" of electrical progress in 1920-1930. To the Bonbright prizes the American Superpower Corporation will in 1930 add a prize of $10,000 for the "review" which shall prove to have been most accurate, thus making it possible for one participant to win $15,000—a present first prize of $5,000 from Bonbright & Company and a deferred prize of $10,000 from the American Superpower Corporation. Surely there are awards numerous and valuable enough to tempt every employee in the electric light and power industry. Interest in them is constantly increasing, and inasmuch as the time for the preparation of papers is growing shorter and shorter, those who contemplate trying for an award must act quickly.

The Conowingo Power Project

THE advancing plans of the Susquehanna Power Company of Maryland for a hydro-electric plant at Conowingo on the Susquehanna River and the discussion of these plans have raised a number of unusual questions which concern several conflicting interests. The answers that are reached will in all probability constitute important precedents in all subsequent discussion of the interconnection of electric power stations situated in more than one state. The site of the proposed plant is in the State of Maryland, whose Legislature has already granted the company a charter. The project, however, emanates from Pennsylvania and, in fact, largely from Philadelphia. The engineering plans have been coming to a head rapidly within the last few months, and the principal construction contract is ready to be intrusted to a well-known firm. The appeal to the Public Service Commission of Maryland to proceed with the work met with immediate opposition on the ground that the interests of the State of Maryland were not sufficiently protected. Permission for construction is apparently to be granted only under the conditions that Maryland shall have the future right to power from this plant at such time as there may be need for it within the state, that water of the Susquehanna estimated to be needed for the water supply of Baltimore within a few years shall be reserved for that purpose, and that certain bridges and roads, the property of Maryland, which would be submerged are to be replaced.

At first it was assumed that these conditions imposed by the State of Maryland might be sufficiently burdensome to kill the enterprise. It now appears, however, that before the Public Service Commission of Pennsylvania the project has met with opposition which, though different in character, is yet apparently of such importance as to constitute even a more serious obstacle. The Philadelphia Electric Company is the chief financial backer of the plan and would apparently take most of the power. One of its customers, however, is the Philadelphia Rapid Transit Company. This company is attacking the whole project on the ground that it is not feasible at this time and that its principal object is the profit of the promoters.

The next phase of the matter will be the joint meeting of the Public Service Commissions of Maryland and Pennsylvania and representatives of the Federal Power Commission in an effort to get together. A welcome indication of progress is found in the Pennsylvania commission's ruling that the detailed investigation of engineering plans and proposed expenditures

requested by the traction company is not necessary at present and that its questions are to be answered in the normal review of the individual commissions. Moreover, the announcement is made that an organization has been devised to prepare agreements on all interstate and federal questions. This is a most encouraging indication that the original hope of the promoters for construction work to be started this spring will be realized. All of the important questions involving the rights of either state and its people, as well as those in which the federal government is interested, would appear certain to be settled by this organization of three different commissions, and it is especially encouraging to note that they have taken the high position that no conflict of local financial interests shall be allowed to interfere with the larger aspects of the project. At the present writing it appears that a compromise will be effected on these large questions and that construction work will soon be under way on this highly interesting and important development.

An Active Building Program

BUDGETS of the light and power companies provide for an expenditure of nearly six hundred million dollars this year. About 50 per cent of this sum will be spent in building or extending generating stations, 20 per cent for transmission lines and 30 per cent for distribution systems. As indicated in the detailed analysis presented in the last issue of the ELECTRICAL WORLD, these expenditures are being made in all parts of the country, but it is significant to note that the greatest activity is found in the South, a section that is developing by leaps and bounds.

It speaks well for the future of the industry that it pours into new construction this year a sum about equal to one-half its gross revenue of last year. Executives must be endowed with courage and confidence to invest this sum, and those who convinced them that the investments were warranted must have been armed with unassailable facts.

System Efficiency the Desirable Goal

ELECTRIC utilities have grown in size and area until they usually depend on more than one generating station and very often on both steam and water-power stations. Under these conditions and with a variable load it becomes important to operate the system stations and the equipment in those stations upon the basis of obtaining maximum system economy and reliability.

This element is often lost sight of in discussing the efficiency of individual stations or unit equipments on a system. The fact that one steam station under best load conditions may produce a kilowatt-hour for 17,000 B.t.u. must be weighed in connection with what other stations are doing at that time and what all stations do during the day or month. The scheduling of machines and stations to insure maximum system economy and reliability under actual load conditions is the fundamental problem for system engineers to study.

A few system analyses on this basis have been made in quantitative detail, and operating and engineering methods have been instituted by using the results obtained from the studies. It has been found fairly easy to use the knowledge in system operations, to make definite schedules and to modify them as system changes occur. More general study of these problems should become the rule if real system efficiency results.

Secondary Alternating-Current Networks

THE desire to restrict the direct-current areas in metropolitan territory and in some cases to eliminate direct current entirely has placed upon engineers the task of obtaining equally good and reliable low-voltage alternating-current service. Several years of development have taken place, and the present status of the work has recently been surveyed in the report of the N. E. L. A. electrical apparatus committee. The three-phase, four-wire systems predominate, with separate mains for single-phase and three-phase service in most cases. Some attempts have been reasonably successful to give combined service from the same mains, but no general solution of the voltage problem has been found. One company has become convinced of the practical and economic advantages of a two-phase, five-wire secondary system; the use of many high-reactance transformers as against a few low-reactance transformers is still debated, and several types of network protectors and protective schemes are being tried in practice.

The general conclusion is that progress is being made rapidly but that much remains to be done before low-voltage alternating current for combined single-phase and three-phase service can attain a parity with direct current in regard to economy and reliability. The outlook is very encouraging, however, and no great handicaps to further advances toward the goal are apparent.

In Two Years Radio Runs Neck and Neck

IT IS taken as a fair estimate that the average residence consumer is using today about thirty dollars' worth of electricity a year. Many exceed this amount, of course, but the majority, take them as they come, pay smaller bills than this to the electric light and power company for all the uses of electric service that they employ, and the average is around thirty dollars—this after twenty-five years or more since the central-station company began to sell.

Radio has been before the public as a household service for a little more than two years, yet already the average expenditure for maintenance of the family that owns a receiving set is somewhere near thirty dollars. In short, a household habitually spends as much today for A and B batteries and tube renewals as it does to the central-station company for energy. In short, the electrical industry, with all the applications of its service, has in a generation succeeded in winning only the same amount in the household budget that now goes to radio.

Of course, radio is entertainment and makes a mighty appeal. But electric service is comfort and convenience. Both play directly to the innate love of luxury that lives in the breast of every man and woman.

After all, the relative ease of selling radio compared with grills and clothes washers and decorative lamps is not the point. The more impressive thought is this—that if after all these years a normal household already spends as much for radio as it does for all the benefits of electricity, the electrical industry has not done a selling job of which it can be very proud. Certainly this comparison should spur the central station, the dealer and the manufacturer to search their methods and find out the reason why.

Practical Aspects of Power-Factor Correction

IT IS unwise and of little use to generalize on the economic and practical aspects of power-factor correction. Although the technical and economic principles apply generally, correction on each system requires a local study of economic, operating and technical features if a correct solution is to be had. Any general conclusion on the best methods for instituting power-factor correction on a national scale must be so modified to suit local conditions that the study becomes long, complicated, subject to exceptions and so formidable in nature that it is no wonder many utilities and prospective users of corrective equipment fight shy.

For a given property and a given class of customers on that property a study of correction reduces to a simple and easy task. A study of the practical aspects of correction in one outlying substation and another study of a typical customer "prospect" give data and permit conclusions which can be relied upon and can be amplified further for system application. All the complexities are ironed out in this method of approach, and a logical starting point for further developments is gained.

Like almost everything else, power-factor correction begins on the ground and not in the air, and there is no panacea except making a businesslike, analytical approach to the subject by the use of specific cases. Rate systems, rules, regulations and generalties come after and not before a knowledge of correction possibilities on a given system is available to those interested in the subject.

Accuracy Increases as the Intensity of Illumination Increases

SCIENTISTS have known for years that the intensities of artificial illumination in general use are of extremely low levels compared with those of daylight under which the eyes evolved. However, until artificial light could be produced at low enough cost little favorable attention could be gained for higher intensities. That time has arrived, and during recent years many startling data have been obtained, which show from various viewpoints that intensities much higher than those in general use are really profitable.

One of the phases which have most recently been subjected to scientific investigation is the relation of accuracy to intensity of illumination. Work of this nature, which is now under way in a laboratory renowned for its scientific work in the utilization of light, indicates that accuracy materially increases as the intensity of illumination increases. Of course, there are almost countless operations in our offices and industries and the visual requirements and tolerances vary greatly. Naturally we may expect that the percentage of increase in accuracy with a given increase in intensity of illumination will be different for various processes.

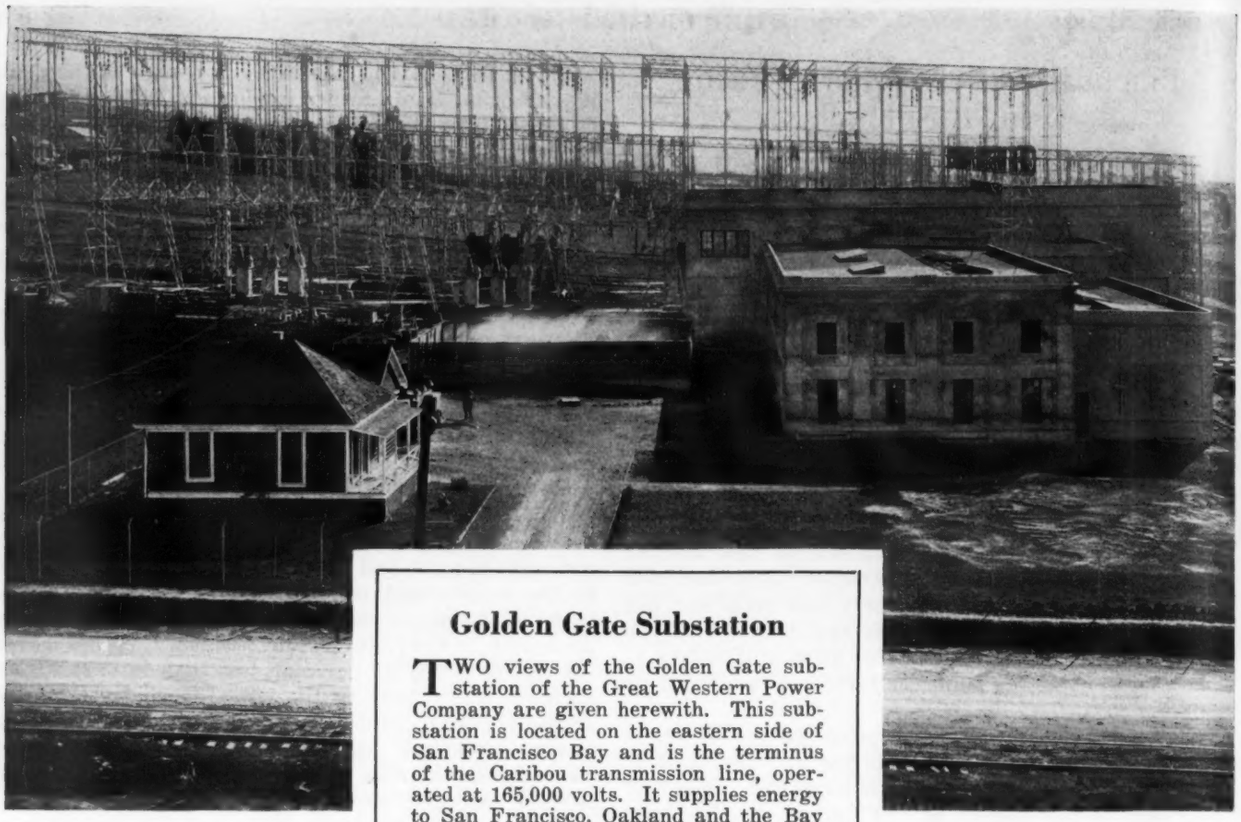
The results of the particular investigation referred to may be considered to be representative of many operations found in offices and factories. When the intensity of illumination was increased from 1 foot-candle to 20 foot-candles the gain in accuracy was 22 per cent. Many operations tax vision much more than this particular one, so it is safe to assume that even more beneficial results would be obtained in these other cases from adequate illumination. Accuracy is related to the quality and quantity of finished products so intimately as to be exceedingly important. Spoilage decreases and production increases when accuracy is increased. Adequate illumination, even aside from its relation to accuracy, increases production and safety and improved morale. Scientists and engineers are establishing facts which prove that adequate and proper lighting pays large dividends.

Cultivate the Small Customer

CONTINUOUS selling programs directed toward developing wider load diversity and greater use of energy by small customers are coming to be fixed policies with many central-station companies. This indicates a definite trend toward more and better commercialism on the part of the electric utilities. That the benefits of such a practice can be counted in dollars and cents of gross and net earnings is well demonstrated in the results attained by the Narragansett Electric Lighting Company last year. In 1924 this company generated 278,187,870 kw.-hr., which was 81,558,740 kw.-hr., or nearly 23 per cent, less than in 1923. This decrease was caused by the lower demand for energy from industrial customers and also by a drop in sales to other utilities. But, notwithstanding this effect of the general business depression, the company's total revenue increased $99,537 over the previous year, and of this increase $80,537 went to net earnings. Such a record was possible only because the Narragansett company has for a number of years pursued a consistent practice of developing the load on residential circuits.

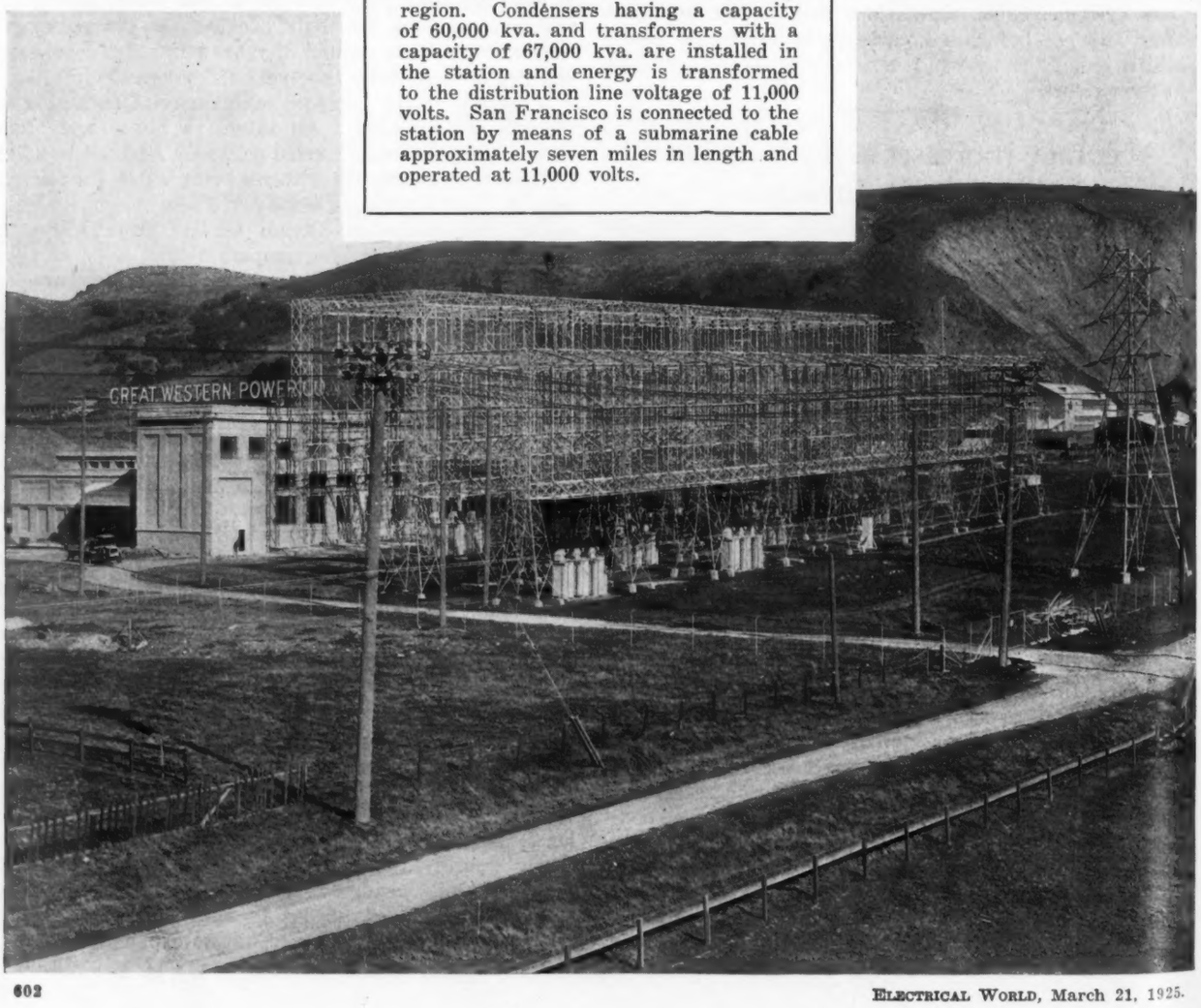
A glance at the company's commercial activities in 1924 is enlightening. An intensive house and store wiring campaign was carried on which resulted in 2,545 old houses and forty-three stores being wired for electric service. By this means alone 4,435 new customers were added, the estimated annual income from whom is $110,000. Moreover, the company's total sales of electrical appliances and lamps reached the figure of $751,018. To carry on this work the company operates eight branch offices and stores and is now completing its ninth. The income from energy used by the appliances sold in 1924 is estimated at $120,000 per year. As a result of this general commercial policy the company in the last three years has succeeded in raising the average monthly consumption of energy by residential customers from 19 kw.-hr. in 1921 to 24 kw.-hr. per month in 1924, an increase of a little more than 26 per cent. In the meantime 32,870 of the company's total of 82,679 customers were taken on, which has had a decided tendency to keep the average individual use at a low figure.

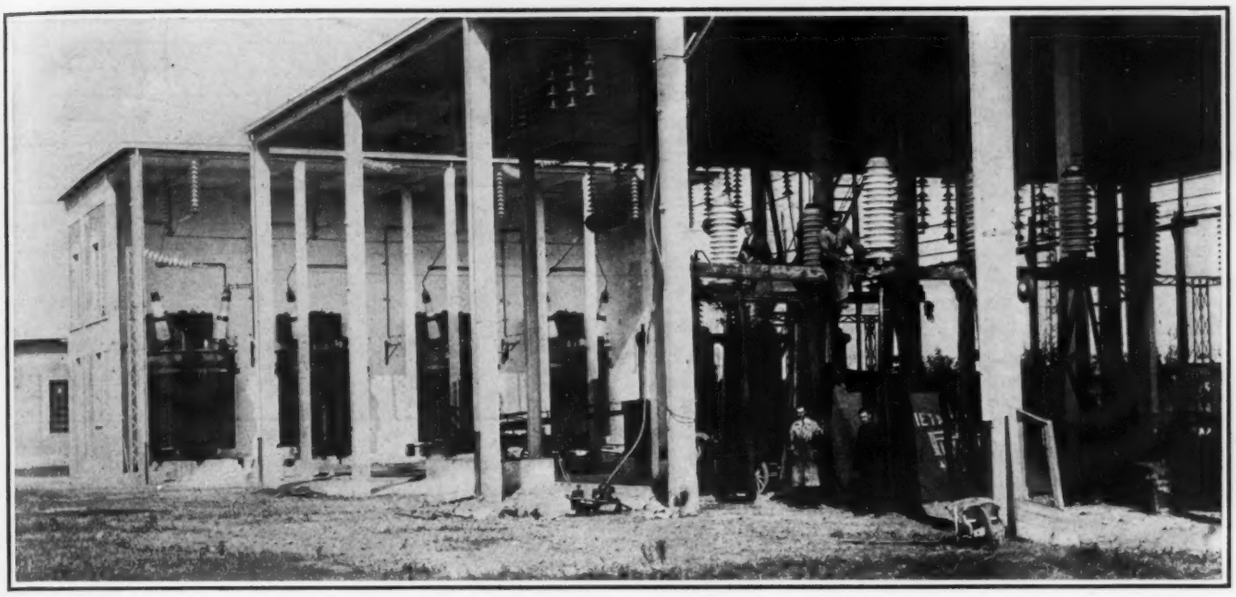
It takes a lot of flatirons and washing machines, vacuum cleaners and even electric ranges and refrigerators to offset a decrease of eighty-one million in kilowatt-hours generated, but in this case it was worth the effort. The Narragansett Electric Lighting Company, in the midst of an industrial slump, was able to show a substantial increase both in gross and net earnings because some years ago the possibilities of the small customer and his diversity of demand were correctly appraised and a definite sales policy was laid down and followed out. The results speak for themselves, but it is significant to note that in 1925 this Rhode Island utility will continue to expand its general sales program.



Golden Gate Substation

TWO views of the Golden Gate substation of the Great Western Power Company are given herewith. This substation is located on the eastern side of San Francisco Bay and is the terminus of the Caribou transmission line, operated at 165,000 volts. It supplies energy to San Francisco, Oakland and the Bay region. Condensers having a capacity of 60,000 kva. and transformers with a capacity of 67,000 kva. are installed in the station and energy is transformed to the distribution line voltage of 11,000 volts. San Francisco is connected to the station by means of a submarine cable approximately seven miles in length and operated at 11,000 volts.





TERMINAL LAYOUT FOR 130,000-VOLT CABLE

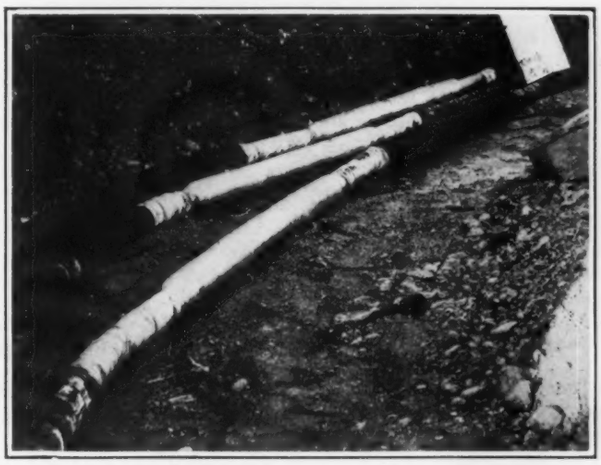
The New 130,000-Volt Pirelli Cable

Successful Results Obtained by Italian Engineers from Experimental Installation—New Design for High-Voltage Cable—Relation Between Dielectric Strength of Impregnated Paper and Its Resistivity to Passage of a Gas Discussed

By PHILIP TORCHIO
New York Edison Company

NOT long ago 33,000 volts was believed to be very close to the limit of safe operating pressure for paper-insulated cables. Only lately this voltage was doubled, still maintaining in the cables the operating reliability of the lower voltages. While this achievement has not had time to dispel completely all doubts about its practical application in the minds of some operating engineers, the news comes of a cable operating at a voltage four time as great. Moreover, this new cable, by departing somewhat in its manufacture and operation from the old practice, seems to lead into a new field of cable construction. Although the cable in question has been placed in operation on an experimental installation, the experiment is made on such a scale as to give assurance of conclusive results.

All of the data given in this article have been secured, on request of some American central station managers, from the manufacturers, who supplied two recent technical articles written by L. Emanueli and published in Italy, with some supplementary information, further clarified by the personal review of their installation engineer, M. Puritz.



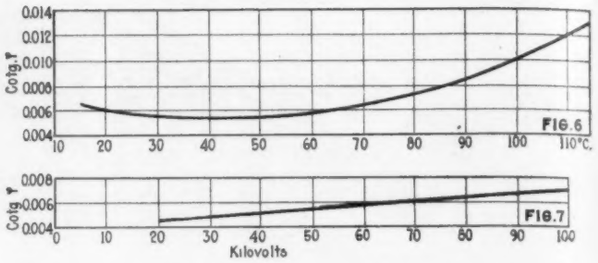
SPLICES ON 130,000-VOLT CABLE

On a 90-mile line of the Società Interregionale in Italy, operating at 130,000 volts, 42 cycles, with ungrounded neutral, a section of 2,000 ft. of No. 1/0 single-conductor cable in three lengths (total 6,000 ft. of cable with six splices and six terminals) has been installed by one of the leading cable manufacturers, the Pirelli company. The cable is made up of a certain number of copper wires stranded around an iron-wire spiral which leaves a hollow core. The insulating paper (43/64-in.) is wrapped around the copper wires in the normal way and is covered with lead, after which a protecting layer of paper and tarred jute has been applied. Experiments made in the manufacturer's laboratories as far back as 1911 brought to light the fact that the dielectric strength of impregnated paper is closely related to the resistivity that the paper offers to the passage of a gas, and special resistivity coefficients were determined for the various kinds of paper and insulating compound. Fig. 1 shows the existing relation between these coefficients (A) and the dielectric strength for the impregnated paper used by the Pirelli company.

It would seem advisable to make cables having all the insulation with a very large value for (*A*) so as to give maximum dielectric strength. However, cables built up in this way would be very difficult to impregnate. The tapering off of the dielectric strength from the inner layer (1,270 volts per mil) to the outer layer (760 volts per mil) was adopted in the cable in question. This gave to the various layers dielectric strength that was more in relation to the dielectric stresses there existing.

Another new feature regarding the manufacture of this cable is that the impregnating of the paper is done after the lead has been applied. The moisture is removed by a current of dry air sent through the hollow core; then the vacuum is applied, after which the fluid compound is allowed to flow in. The hollow-core construction adopted supplies the means for filling up the empty spaces which are formed every time that the cable goes through a certain temperature cycle, maintaining always a perfect impregnation of the dielectric. Fig. 2 shows how the power factor (cotg. ϕ) of a cable is affected after it has been warmed up and cooled down again.

The hollow-core construction has also simplified somewhat the splice construction, which is made of built-up insulation around a copper sleeve which supplies the continuity of the hollow core and on which the copper wires of the conductor are soldered, as the perfect impregnation that can be obtained by it permits keeping the size of the lead sleeve of a splice down to a diameter slightly larger than the cable.



POWER FACTOR AS RELATED TO VOLTAGE AND TEMPERATURE ON THE PIRELLI CABLE

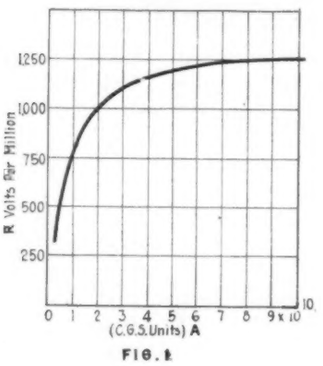
Fig. 6—Power factor and temperature relations under tests at 50,000 volts.

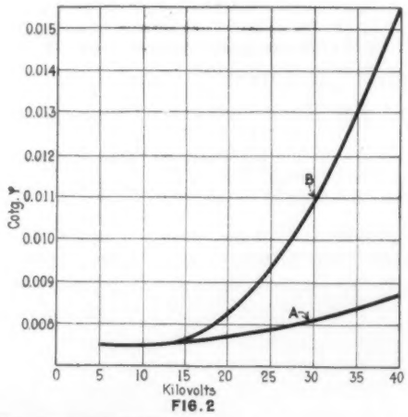
Fig. 7—Power factor and voltage relations at a temperature of 30 deg. C.

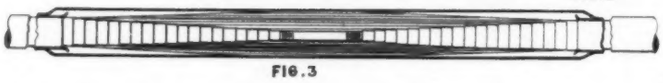
The terminals for cables operating on this high voltage presented two main difficulties—one of an electrical and the other of a mechanical character.

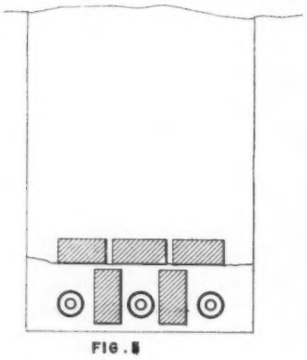
The first one was given by the tangential dielectric stresses that are formed at the point where the lead terminates, and a special metal shield had to be devised to keep these stresses within certain limits until sufficient thickness of insulation had been built up around the conductor.

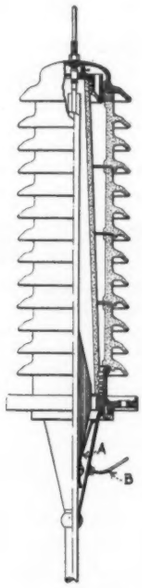
The second was given by the necessity of making the pothead oil-tight and was overcome by making the pothead in two parts, one inside the other, and filling the inner, which connects with the oil tank, with the cable compound and the outer with a solid compound (Fig. 4).











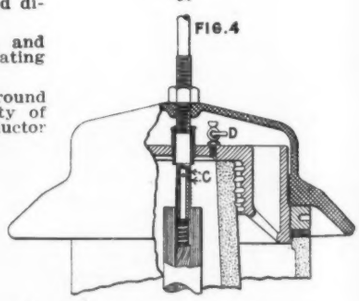


Fig. 1—Relation between resistivity coefficients and dielectric strength.

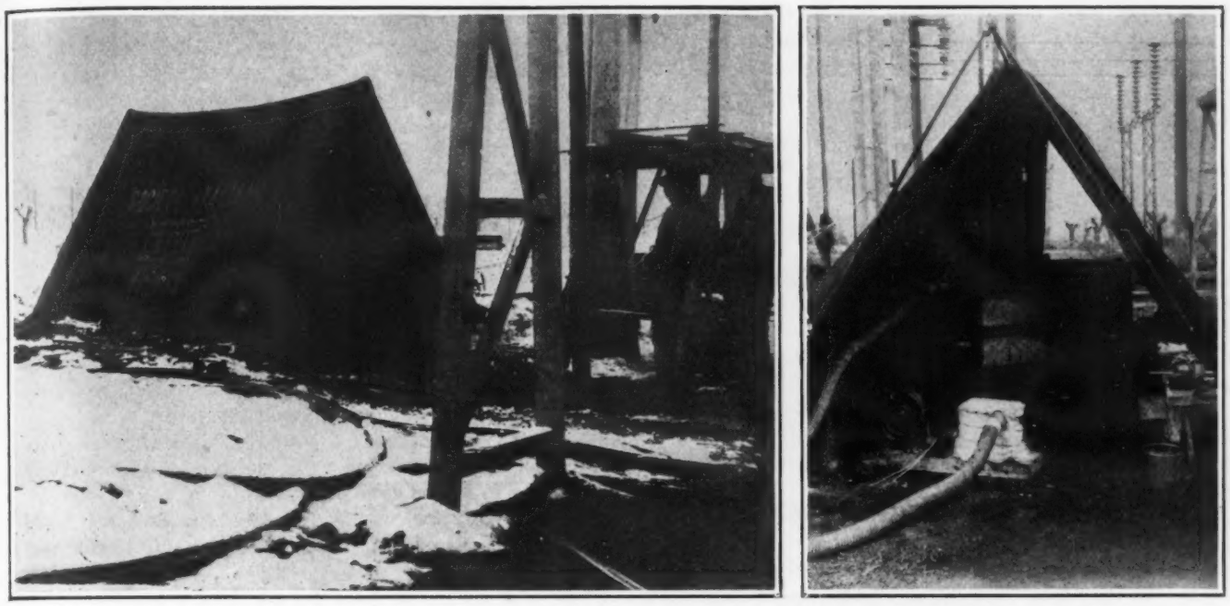
Fig. 2—Relation between power factor (cotg. ϕ) and voltage (*A*) before heating the cable; (*B*) after heating the cable to 100 deg. C. for four hours.

Fig. 3—Splices are made of built-up insulation around a copper sleeve. The sleeve supplies the continuity of the hollow core and the copper wires of the conductor are soldered to it.

Fig. 4—Pothead for 130,000-volt cable.
(*A*) Electrostatic shield.
(*B*) Oil intake.
(*C*) Openings for oil.
(*D*) Cock for discharging gases.

Fig. 5—Layout for a 130,000-volt cable line.

TECHNICAL DATA AND CONSTRUCTION DETAILS OF THE PIRELLI CABLE



AT LEFT, LAYING 130,000-VOLT CABLE WITH WEATHER BELOW FREEZING AT RIGHT, FIELD WORKSHOP FOR MAKING SPLICES, SHOWING HOT-AIR BLAST EQUIPMENT FOR REMOVING MOISTURE

After the cable was laid in the ground, arranged as shown in Fig. 5, the splices made, using special precautions to limit the moisture while splicing, and the potheads connected, the vacuum was applied while an electric current was made to flow through the conductor to facilitate the drying of the cable, following which the cable was filled with compound.

Special oil tanks, placed a few feet above the highest point of the cable and made moisture-tight in a way similar to that adopted for transformers, maintain the cable thoroughly impregnated at all times, allowing the taking up of any expansion or contraction of the cable due to changing temperature. The lead sheaths of each conductor were connected together at each end and solidly grounded.

The cable is wound around an iron wire spiral which leaves a hollow core.

Factory tests were made on each cable length between conductor and lead as follows: 150,000 volts for fifteen minutes, 175,000 volts for one minute, 200,000 volts for one minute.

One cable length was tested as follows: 275,000 volts for two minutes, 150,000 volts for twenty-four hours, without giving evidence of hot spots.

The pothead, mounted on a sample, was tested at the factory as follows: 200,000 volts for fifteen hours, 250,000 volts for forty-five minutes, 300,000 volts for ten minutes.

After the cable was laid, the following field tests with the line transformers were made: One phase against ground at 72,000 volts and 90,000 volts for three minutes, 110,000 volts and 120,000 volts for five minutes, between phases 87,000 volts, 118,000 volts and 153,000 volts for five minutes, 180,000 volts for about thirty minutes.

The results of power-factor tests (cotg. ϕ) made at the factory are shown in Figs. 6 and 7.

The cable was laid in November, 1923, with a temperature between 0 deg. and —5 deg. C. The line was placed in service from March 20, 1924, to May 15, 1924, at 65,000 volts, and since October 6, 1924, it has been operating at 130,000 volts with ungrounded neutral. There is no doubt that great interest will be shown by the industry in the results obtained in this daring step, which, if it proves as reliable as we are inclined to think, will undoubtedly play an important part in facilitating the solution of many interconnections between large power companies.

Electrification of Rural Districts in France

FOR many years three electrical companies have been giving electric service in the towns and more important localities of the Department of Loire Inférieure in France. The public authorities, desiring to provide electric service to the rural districts of the department, have concluded an agreement with these three companies to accomplish that end.

The project now on the way to realization does not provide for the complete electrification of the farming areas. The population of the department is, so to speak, disseminated or disposed in hamlets and on individual farms, and provision has been made, for the present at least, for the electrification of only the principal agglomeration of towns.

Lines at 60,000, 30,000 and 15,000 volts, branching from the existing system in the department, will serve all towns not yet enjoying electric service, the supply being three-phase, 50-cycle alternating current. These lead in each town to a stepdown transformer connected to the low-tension system which distributes directly to the customers' installations. The voltage of the secondary distributing system is either 120/210 volts or 220/380 volts. The latter distribution voltage is expected to make it easier in the future to extend electric service to more isolated localities and farms which are not included in the program actually in course of completion.

The department has granted to each of the societies a "concession of state for public service," and each town has granted the right to render electric service in its territory to the company that serves the region in which the town is situated.

The high-tension lines (15,000, 30,000 and 60,000 volts) of the system are built by the companies, but at the expense of the department. The latter borrows the necessary funds and plans to pay interest on them by means of taxes which it may impose and royalties that the companies agree to remit from rates charged for the rural electric service.

As to the towns, they may choose between the three following methods for construction of the low-tension distribution system:

1. The enfranchised company to construct the town low-tension system entirely at its own expense. The town then guarantees an annual return on the fixed charges thus incurred.

2. The town supplies four-fifths of the investment in the local system.

3. The town constructs at its own expense the local system—in this case the company pays the town a part of the receipts from the sale of energy in the town.

In each case the energy is sold by meter. To the regular fixed rate is added an increment which varies from time to time to fit the current "economic situation."

The following rates are typical:

	Francs— Light	Power
Nantes	0.90	0.40
In rural districts with state aid	1.75	1.05
To be remitted to the department	0.35	0.12
Accruing to the company from rural rates	1.40	0.93

On this basis it appears that the department expects to be repaid in about thirty years. It should be understood that no paper is exchanged—in other words, the department's contribution is not a loan. The department anticipates that it will make up any deficiency which may occur in interest or in principal amortization from taxes.

In Nantes and several other communities private enterprise is rendering electric service on a self-supporting basis and there is no need for state interference or contribution, but to get started in other regions the state recognizes that it must go in to help.

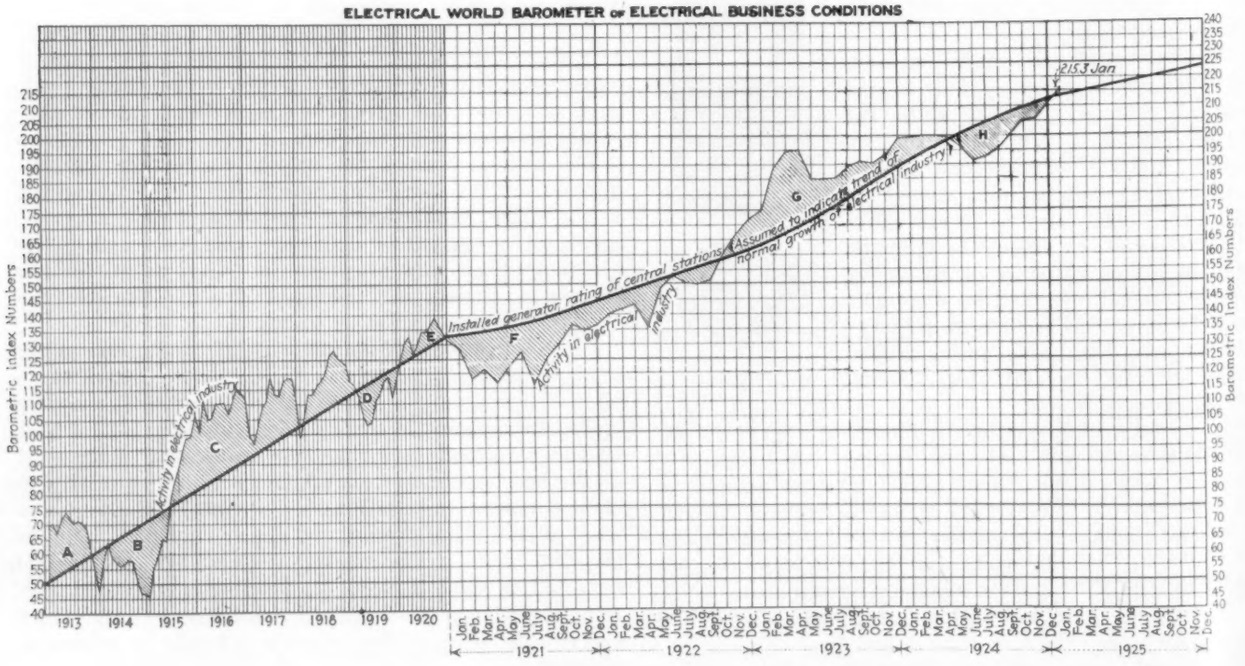
The concession which has been granted by the department has the provision common to all French concessions that the concession reverts to the conceding authority without cost at the end of its term. The conceding authority, however, to take advantage of this provision, must repay to the company all capital expenditures of the last twenty-five years. No case has yet arisen where the authority has exercised its right of recapture. The authority either issues a new concession—that is, extends the concession as it was originally—or else renews it with some modifications and conditions to fit the existing situation.

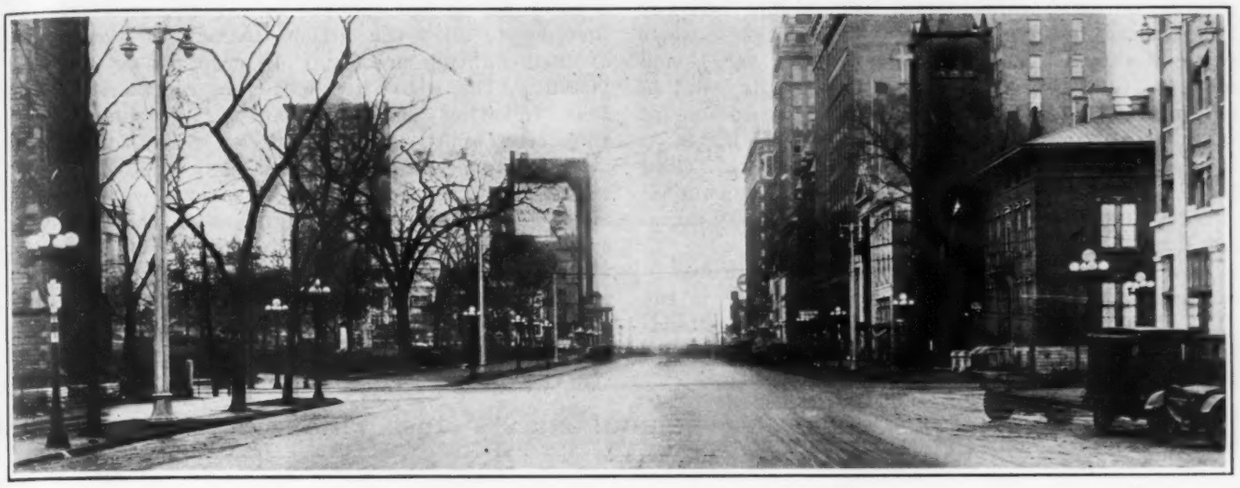
The present project covers plans for 600 km. (375 miles) of transmission line, reaching 180 towns and villages.

January Business Above Normal

PRODUCTION data upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that January witnessed a further increase in the activities of the industry. General business continued to improve, and production in most primary industries also increased.

During January the electrical industry as a whole was operating at 1.6 above the estimated normal. Corrected figures for previous months indicate that January was the first month since last April when the industry was operating above normal. In December it was operating at 0.7 per cent (revised) below normal and in November at 5.8 per cent (revised) below normal, thus indicating that the upward swing in the operations of the industry which started in July has continued into the present year.





DAY VIEW OF TYPICAL LAMP STANDARDS INVESTIGATED

Columbus Street-Lighting Survey

Scope of Investigating Committee's Report, Based on Watts per Linear Foot, Determining Illumination Requirements of Ohio Capital After Two Years' Study of Specimen Lighting Standards

WITH the realization of high-visibility illumination on its highways, after the manner outlined in a report recently issued as the result of a two-year study, Columbus, the capital of Ohio, will gain a place in the ranks of the best-lighted cities in the United States. The report referred to, promulgated by a committee chosen through the Columbus Chamber of Commerce and composed of both engineers and laymen, is unique in three respects—first, because, despite the extent of the survey on which it is based, it is not so over-elaborate that it loses its clearness in briefly outlining the general requirements which would solve the street-lighting problem in Columbus; second, because the committee has chosen as a unit, not foot-candles or other highly technical measurements of lighting, but "watts per linear foot of street"; third, because the committee has stressed "visibility," which is the most important part in street illumination.

These three features stand out in the report because the committee was imbued with the idea of not making tests of too scientific a nature, which might possibly be meaningless to the public. The committee's report was only to produce a guide for the city authorities in improving lighting conditions and to outline a method to obtain this improvement.

The history of the committee goes back two years. At that time the Chamber of Commerce in Columbus, lamenting the deplorable condition of the street-lighting system, was asked by the city to study the situation and make a report. A committee was then formed consisting of seven men, three of whom were engineers while the others were chosen because of their interest in civic matters. M. S. Hopkins, consulting engineer, was appointed chairman, with Dean E. A. Hitchcock of the College of Engineering, Ohio State University, and F. C. Caldwell, professor of electrical engineering, Ohio State University, as the other engineering members. The other members on the committee were Ralph H. Beaton, broker; A. H. Bancroft, jeweler; William J. Longbon, real-estate agent, and William M. Hekking, director Columbus Gallery of Fine Arts.

TYPE OF UNIT BEING USED IN COLUMBUS

This committee has now made its report, which includes recommendations for improvement in and for standardization of street lighting in Columbus. The report is the result of a long series of investigations based on manufacturers' exhibits actually installed on the streets of the city. The table reproduced gives data on these exhibits and indicates their appearance.

The one guiding keynote of this committee's test work was the determination of the correct amount of illumination, when rightly placed on the street, to be of the greatest value to the public. The effectiveness of proper street lighting requires that the street itself shall be better lighted than its adjacent boundaries in order to have a strong enough contrast between the street and the surroundings. This permits the eye of the motorist to adjust itself quickly to moving or stationary objects. For

instance, on approaching a city from a dark highway the eye is adjusted to almost maximum vision because of the darkness. Therefore, naturally a very small amount of light is necessary for good visibility. But as the eye gradually adjusts itself to the increased amount of foreign lighting the street lighting must be increased to offset this natural adjustment of the eye. Good street lighting, however, is based on the amount of light required to produce the degree of visibility necessary for commercial use.

The following recommendations were based primarily on what constituted good commercial visibility in the minds of the committee and hundreds of laymen attending the nightly tests of the exhibits which were actually set up in Columbus by various manufacturers in order to allow the citizens to make a home study of their lighting problems. In order to get the best visibility, the committee took into consideration the four following points: Glare or dazzling effect; silhouette, ability to see objects in outline; direct illumination; general appearance both during day and night. Naturally, the above conditions were in turn affected by the height of light above the street by spacing the question of large units with longer spacing versus smaller units with shorter spacing; by the matter of the location of units, whether directly opposite one another on both sides of the street or in the alternating positions known as "staggered" and by

Manufacturers' Installations on Columbus Streets

	Central Business Lighting							Business Lighting					
Group	1-A	1-C	1-E	2-A	2-C	3-A	3-C	4	5-A	5-C	5-E	5-G	6-
Number of test standards.	5 single 5 twin units	5 single staggered units	5 twin ornamental units	6 twin ornamental units	3 twin ornamental units	5 twin ornamental units	Same as 3-A	4 single ornamental units	10 single ornamental units	6 single ornamental units	4 single ornamental units	4 single ornamental units	10 si ornam units
Spacing in feet on test....	102 set opposite	102 set staggered	102 set staggered	135 set opposite	135 set alternately	102 set staggered	102 set staggered	One at each block corner and three equally spaced between	40 set staggered	80 set staggered	120 set staggered	120 set staggered	40 s oppo
Street location for tests. .	High St. from Spring to Long St.	Same as 1-A	Same as 1-A	High St. from Gay St. to Lynn St.	Same as 2-A	High St. from State to Town St.	Same as 3-A	High St. corners from State to Town St.	One block from Gay St. south on Front St., 490 ft.	Same as 5-A	One block south from Long St. on Front	Same as 5-E	One b on To south Gay
Mounting type.....	Westghse. "A" iron post and casing at curb line	Westghse. "A" iron post and casing at curb	Westghse. "A" iron post duplex extension at curb	Union Metallic Mfg. Co. pressed steel standard ornamental	Union Metallic Mfg. Co. pressed steel standard ornamental	King Mfg. Co. ornamental C.I. standard at curb	King Mfg. Co. C.I. standard at curb		G.E. rebuilt the present five-cluster C.I. pole for single fixture	Same as 5-A	G.E. rebuilt the present five-cluster C.I. pole for single fixture	Same as 5-E	West rebuil pole single fixtu
Mounting height in feet..	16.6	16.6	20.66	20	20	18 and 20	18 and 20		16.5	16.5	16.5	16.5	
Distance from street center in feet.	30	30	30	30	30	30	30		30	30	30	30	
Lighting unit.....	Westghse. octagonal, senior tops	Westghse. octagonal, senior tops	Westghse. Paragon, senior ornamental	G.E. luminous arc	G.E. luminous arc	G.E. Novalux No. 12 ornamental	G.E. Novalux No. 12	G.E. Novalux	G.E. Novalux No. 9	Same as 5-A	G.E. Novalux	G.E. luminous arc	West octag reflect post
Lamp size..... Number used in test.	Mazda C 10 1,000-cp. one per standard	Mazda C 5 1,500-cp. one per single standard	Mazda C 10 1,000-cp. two per standard	Luminous arc, 6.6 amp. one per standard	Luminous arc, 6.6 amp. two per standard	Mazda C 10 1,000-cp. two per standard	Mazda C 5 1,500-cp. one per standard	Mazda C 1 1,500-cp. 3 1,000-cp. one per standard	Mazda C 10 600-cp. one per standard	Mazda C 6 1,000-cp. one per standard	Mazda C 4 1,500-cp. one per standard	Luminous arc, 416.6 amp. one per standard	10 60 Mazd one stand
Refractor.....	Westghse. Bi-Lux	Westghse. Bi-Lux	Westghse. Bi-Lux										West Bi-L
Glass.....	Florentine, clear with one surface with irregular configurations	Florentine, clear with one surface with irregular configurations	Opalescent, flashed rectilinear globe and canopy	Medium-density alabaster rippled globe, No. 118	Medium-density alabaster rippled globe, No. 118	Medium alabaster rippled globe, No. 124 canopy rippled No. 1124	Same as 3-A		Light alabaster rippled glass	Same as 5-A	Medium-density alabaster rippled globe, No. 118	Same as 5-E	Clea Flore or Sp
Watts at lamp.....	518	770	518	528	528	518	770	3,094*	310	518	770	528	
Volts at lamp.....	25.9	38.5	25.9	80	80	25.9	38.5		15.5	25.9	38.5	80	
Watts per linear foot of street by test.	10.6	7.8	10.6	7.8	7.8	10.6	7.8	6.1	6.32	6.3	6.3	4.3	
Desired watts per linear foot of street.	8	8	8	8	8	8	8	6.0	6.0	6.0	6.0	6.0	
Ratio actual test to desired	1.32	0.97	1.32	0.97	0.97	1.32	0.97	1.01	1.05	1.05	1.05	0.72	
Remarks.....													

* Total wattage per block.

the kind of reflector or refractor used to redirect the light. While this investigating committee considered all the above items, it did not attempt to specify to the city authorities an actual lighting equipment design, but merely tried to show what constituted good city street lighting.

In order to produce by means of increased illumination gradually increased visibility extending from the outskirts of the city into the city center, the committee suggested a series of zones be established in approximately circular lines with Broad and High Streets as a center. The center zone, or the central business lighting, is to be limited to 8 watts per linear foot of street, except for those portions of Broad and High Streets lying at the center of the central zone. This zone is to be furnished with 15 watts per linear foot, thus giving a "white way" effect and producing the climax of lighting for the city. The recommendations for the other zones are as follows per linear foot of street: Central business lighting, 8 watts; business lighting, 6 watts; boulevard lighting, 2½ watts; residence lighting, 1¼ watts; "white way" lighting, 15 watts or more.

In order to keep the expense as low as possible the committee has recommended that the surplus standards of the present type be used with extensions wherever possible. Tests were run with this type of equipment as shown in No. 5-A-B-G, 6, B and 16 of the table.

Which Were Studied for Proper Illumination Effects

	Residence Street Lighting				Boulevard Lighting			"White Way" Lighting						Present Units in Columbus Business Districts
5-C	7-A	7-C	7-E	8	9	10	11	12-A	12-B	13	14	15-A	15-B	16
ingle mental nits	6 pendent units	6 pendent units	6 pendent units	7 pendent units	6 pendent units	5 pendent units	6 pendent arc lamps	6 single, 4 twin units	6 single, 4 twin units	6 twin units	5 twin units	6 twin units	6 twin units	5-light standard installed
0 set rately	184	184	184	210	138	123	115	102 set opposite	102 set opposite	135 set opposite	102 set staggered	245 set opposite	245 set opposite	In Columbus business streets
me as 5-A	Dennison Ave. from King to Fifth Ave. 1,106 ft.	Same as 7-A	Same as 7-A	1,250 ft. on Dennison Ave. from Second to Fourth Ave	685 ft. on Neil Ave. from Fourth to Third Ave.	613 ft. on Neil Ave. between First and Second Aves.	700 ft. on Neil Ave. from Wilbur to Buttles Ave.	High St. between Spring and Long Sts.	Same as 12-A	High from Gay to Lynn	High from State to Town	735 ft. on Broad east of High	Same as 15-A	Entire downtown district
me as 5-A	Special 5-ft. street bracket on wooden pole	Same as 7-A	Same as 7-A	Mast arms	Bracket 5 feet long, straight type	Wrought-steel pipe with C.I. base and 6-ft. straight bracket	Street system brackets, 5-ft. straight type	Westghse. "A" C.I. post and casing at curb		Union metallic pressed steel	King Mfg. Co. C.I. posts	Massey concrete, hollow-spun post	Same as 15-A	C.I. with ornamental
16	18	18	18	18	20	18	20	16.58	16.58	20	20	30	30	12.5
30	10	10	10	9	20	19	20	30	30	30	30	60	60	30
me as 5-A	G.E. Columbus unit	Same as 7-A	Same as 7-A	Westghse. C.I. Luxolite	G.E. Novalux No. 25	Westghse. Paragon, pendent	G.E. No. 17 luminous arc	Westghse. Paragon, senior top	Same as 12-A	G.E. luminous arc	G.E. Novalux	Line material fixture	Same as 15-A	
5 00-cp. da C e per dard	6 250-c.p. Mazda C one per standard	6 400-cp. Mazda C one per standard	6 600-cp. Mazda C one per standard	7 600-cp. Mazda C one per standard	6 600-cp. Mazda C one per standard	5 600-cp. Mazda C one per standard	6 4 amp. luminous arc, one per standard	10 1,500-cp. Mazda C	10 1,000-cp. 5 1,500-cp. Mazda C	Luminous arc, 6.6 amp.	10 1,500-cp. Mazda C two per standard	12 1,450-cp. Mazda C two per standard	12 2,000-cp. Mazda C two per standard	4 75-watt 1 100-watt Mazda C five per standard
me as 5-A	Solid porcelain reflector	Same as 7-A	Same as 7-A	Holophane two-way and four-way	Fire metal or enamel reflector	Porcelain-enameled steel reflector	Fire enamel or metal reflector	Westghse. Bi-Lux	Same as 12-A			Porcelain reflector	Same as 15-A	
me as 5-A	Alabaster rippled globe	Same as 7-A	Same as 7-A	Holophane	Basket light alabaster rippled globe	Opalescent flashed rectilinear globe	Light alabaster rippled globe	Florentine, clear with one surface of irregular configurations	Same as 12-A	Alabaster rippled globe No. 118	Alabaster rippled globe No. 124 canopy No. 1124	Holophane	Same as 15-A	Frosted bowl
518	152	244	310	310	310	310	310	770	770	528	770	750	1,000	400
25.9	23.1	37	54.7	15.5	15.5	15.5	75 to 80	38.5	25.9	80	38.5	110	110	110
5.3	82	1.32	1.96	1.49	2.7	2.5	2.6	15.7	18.4	15.1	15.7	12.2	16.3	8.2
6.0	1.25	1.25	1.25	1.25	2.5	2.5	2.5			— not specified —				
0.86	65	1.06	1.56	1.18	1.08	1.00	1.04	....						
								Lights arranged six on single standards opposite and four on street side of twin standards	Lights two per twin standard staggered and five 1,500-cp. per single standard, staggered	Two lights per standard				Installed with 40-ft. spacing, 10 units to the block

NIGHT VIEW OF TYPICAL LAMP STANDARDS INVESTIGATED

Upon investigation of the choice of illuminants for the "white way," central and business district, the committee selected for comparison 1,500-cp. incandescent lamps and the luminous arc operating at 6.6 amp. The reason for the choice of the two sources of illumination was that the arc lamp gives a white light under which objects appear in their true color but an incandescent lamp gives a yellowish light and therefore does not show objects in their true color. Though the yellow light of the incandescent lamp is also of the same color as the show windows, thereby producing no contrast for display effect, the arc lamp giving the white light, in direct contrast with the yellow incandescent lamp in show windows, does produce a pleasing and attractive impression.

COMMITTEE RECOMMENDATIONS

The committee recommended the use of not less than two 1,500-cp. lamps on the "white way" system when 15 watts per linear foot intensity was desired. It took cognizance of the prophecies made by the late Dr. C. P. Steinmetz at the Illuminating Engineering Society's annual convention in Washington, December, 1915, when he declared: "We have not as yet reached the limit of possible efficiency of the incandescent lamp, but we are fairly close thereto as the efficiency is theoretically limited by radiation laws, while the efficiency of the arc lamp has no theoretical limit. In addition to street illumination using arc lamps there is a considerable amount of light coming from stores and other sources which is yellow. Whenever, then, these two illuminations blend into each other they destroy each other's effect. This is where the main advantage of 'white way' lighting lies in decorative schemes."

For the central business lighting outside the "white way" district the committee recommended that the luminous arc lamp be used, or the 1,500-cp. incandescent lamp. It recommended that single lamps be spaced seven to the block, which will permit future changing to display lighting by the addition of a two-lamp bracket at a minimum expense. The committee further recommended that the present five-cluster standard be rebuilt as indicated in tests 5 and 6 of the table. However, for the future, if it should be desired to increase the display area, a new 20-ft. standard with twin brackets and additional lamps should be purchased.

For streets intended to have the general business lighting the committee decided that the present five-cluster standards with ornamental white globes and consuming 8.2 watts per linear foot could be replaced by four of the newer types of lamps, using only 6 watts per linear foot, which would be more economical to operate. This substitution would require only four to the block instead of ten, as with the present five-lamp standards. The committee also recognized that certain business sections would require the use of arc lights. Various types of reflectors and refractors were installed and tested, but the committee did not recommend their general adoption. It did recommend, however, that all fixtures be arranged so that reflectors and refractors can be used and that a certain number be purchased and receive a fair trial.

For boulevard lighting the committee recommended 600-cp. incandescent lamps similar to those used in tests Nos. 9 and 10 in the table. The committee determined that the lamp should be suspended in a straight line about 5 ft. from the curb line and that the standards should be staggered with an average spacing of 123 ft.

For residence lighting the pendent lamp was recommended with the fixture used in tests Nos. 7 and 10, where an extension arm of new design could be readily mounted on ordinary wooden poles. These pendent lamps were to use 250-cp. incandescent lamps, spaced so as to consume about 1¼ watts per linear foot. The committee also suggested the trial of asymmetric refractors fitted in water-tight units for residence lighting.

As an outcome of studying this general problem of street lighting, the committee discovered the importance of lighting up the front of business buildings where the appearance of the street at night is of major importance. This is now very difficult to do if the

material of the building front is of a dark color. The committee is urging the Chamber of Commerce to further a movement for the exclusive use of light-colored building materials for the front of buildings on business streets in order to effect a more pleasing appearance at night time.

Although this committee merely gave a general outline of the lighting requirements, it is expected that the City Council will approve the outline and turn over the work of investigation to the engineering department of the city, which will prepare plans and specifications for bids on the entire program. The expense of this rehabilitation will undoubtedly be assessed against the property owners, while the energy will be supplied through the municipal lighting plant and paid for by the city.

Avoiding Flashovers on 220-Kv. Transmission Lines

Southern California Edison Company Finds That Bird Guards Will Furnish a Solution of Problem—Various Types Described

By G. H. STOCKBRIDGE
Superintendent Transmission, Southern California Edison Company, Los Angeles, Cal.

FROM the time the Big Creek lines of the Southern California Edison Company were placed in operation at 150 kv. until their reconstruction for 220-kv. operation occasional flashovers, averaging one or two a month, were experienced. These were not considered of vital importance, as they usually occurred at a period of light load and were of short duration, but with the proposed change to 220 kv. and the increased loading of the lines it was thought best to try to elminate them.

Not long before the reconstruction work started, and as a result of fortunate observation by one of the chief patrolmen of the actions of an eagle perched on a transmission tower, the theory was advanced that it was possible for an eagle to ground the line to the tower without leaving any marks on the insulator, on the tower or on the bird itself to show what caused the trouble. The theory that birds were causing all the flashovers was at once applied to the known conditions, which were as follows:

First—No flashovers had ever occurred close to a switching station, to a house or to a well-traveled road.

Second—Most of the flashovers had occurred on the center conductor, where the birds were known to roost.

Third—A large proportion came during the early morning hours.

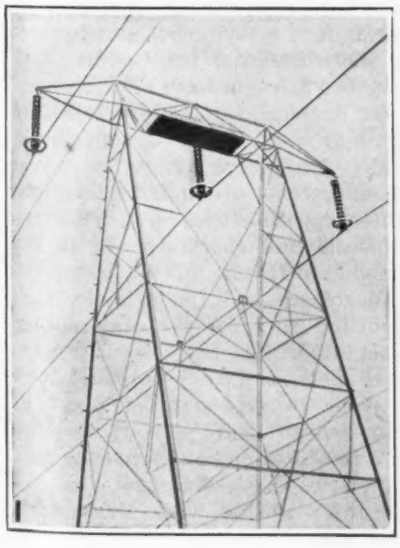
Fourth—In every case service was immediately restored on the line, showing that the conditions were transient.

Fifth—In a number of cases flashovers occurred on complete strings of good insulators where there were strings with two or more bad units in close proximity on the same conductor.

Company engineers concluded that the flashovers on the center insulator string could be stopped by preventing the eagles from perching in the center of the tower. With this in view a guard made of metal straps to cover the crow's nest of the tower, from which the center string is suspended, was designed. After placing these guards on the line along 50 miles of the worst section it was found that the eagles had disappeared in this section, but the flashovers continued at the same rate. A little more careful observation showed that where there were flashovers there were hawks, and where there were hawks there were flashovers.

While this experimental work was going on the work of reconstruction was progressing. This work consisted of adding two units to each insulator string and a shield ring 2 ft. in diameter around the bottom unit and a shield consisting of a band ring of the same diameter around the top unit of the center string.

Impressed with the idea that the hawks also were responsible for flashovers and that the guards as installed were not sufficient to keep the birds entirely away from the center of the tower, additional guards were installed in the same section. It was thought that by tightly stringing ¼-in. galvanized cable parallel to and 4 in. above the horizontal tower members the hawks would be unable to find a satisfactory roosting place and the flashovers would be greatly reduced. The tower



PROTECTION AGAINST BIRDS ON 220-KV. TOWERS

Fig. 1—Bird pan over center conductor on a 220-kv. steel-tower.

Fig. 2—Latest type of bird protection, consisting of saw-tooth guards over center conductor. Total cost per tower approximately $12 installed.

Fig. 3—Saw-tooth guard over outside conductor. Strips are 4 ft. long and galvanized after punching.

members did not lend themselves particularly well to this construction, but it was cheap and easy to try and would serve to demonstrate the truth or falsity of the theory. These guards produced results immediately, the flashovers jumping from two a month to twelve before steps could be taken to cut them down.

Each succeeding flashover showed that the hawks were now roosting on the top ring which had been put on during the reconstruction, and whereas it had previously been the exception to find bird droppings on the insulators, now in every case the insulator strings were soiled from top to bottom and in such a way that the bird could have been nowhere else except on this top ring. It seemed impossible for a bird roosting at the top of the insulator string and under the cross-arm member to cause a flashover and escape alive, but the proof that numbers of them were doing it was indisputable.

Several things indicate that a flashover started in this way does not start with a rush of current, but gradually builds up in intensity until a short circuit develops. The first indication of a flashover in the dispatcher's office is the ringing of the telephone bells for two or three seconds before any system disturbance develops. If a flashover occurs while the wind is blowing, it invariably starts on the windward side of the conductor support and in blowing around to the lee side only slight pits, in some cases hardly discernible, are left, showing but little current at the beginning of the flashover.

On learning what had happened, it was decided to remove the top rings from the center insulator strings as it was found that flashovers in the field did not strike in to the top insulator as laboratory tests had indicated. With the removal of the rings the flashovers dropped back to two a month, and an inspection of these and of numerous places where they did not occur demonstrated that the hawks were still roosting on the tower members above the conductors in spite of the cable and other guards.

USE OF PAN GUARDS

At this time a 30-mile section was equipped with a different type of guard. A galvanized pan was placed at the top of the tower the full width of the cross-arm, extending out 4 ft. each side of the conductor support, as shown in Fig. 1. While this is not considered 100 per cent protection, because the edges of the pan are not properly protected and no attempt is made to safeguard the outside conductors, no flashover has occurred in this section since the pans were installed.

It was thought that the discomfort and inconvenience of roosting on the guard wires would ultimately discourage the birds from trying to roost in the center of the tower. This apparently happened to some extent as the flashovers dropped below one a month during the summer, a large part of these being on outside conductors and dead-end towers, none of which are properly protected. In all cases of dead-end flashovers the initial arc jumps from the bottom of the jumper loop to the cross-arm, and in several cases 3 ft. to windward, making a jump through the air of 7 ft.

About half of these show unmistakable traces on the arm and on the jumper loop where the arc started that they were caused by birds, and the rest are logically accounted for in the same way. The common red-tailed hawk appears to be the worst offender as he is to be found along the line the year around, but with the coming of winter other birds of a more migratory nature have caused an increase in interruptions. Only one flashover has occurred on the Big Creek lines where the men in the field were in doubt as to the cause. This occurred near the Magunden switching station during a misting rain. A heavy freight train was passing, and the steam and smoke were rolling directly through the tower when the flashover occurred. As the smoke rolled away a small hawk flew out of the center of the tower and introduced an element of uncertainty into the question of cause.

NEW TYPE NOW USED

For the new Eagle-Bell 220-kv. line a new type of guard of a saw-tooth shape has been developed which, if properly applied, will, it is believed, be 100 per cent bird-proof. Two installations of this type are shown in Figs. 2 and 3. It is attached to all the horizontal tower members above the conductors with metal straps and stove bolts. The members are protected 4 ft. each way from the conductor, as observation has shown that this distance is necessary for protection with a breeze blowing. Guards of this type are now being installed on the original Big Creek lines, and experience so far indicates that they will produce the desired results in preventing flashovers.

On the Edison company's 60-kv. lines bird guards made from 1-in. mesh-wire cloth have been used very successfully in reducing interruptions, but the conditions are even more severe on these lines as it has been proved that a sparrowhawk half the size of a pigeon can ground a 60-kv. dead-end jumper loop through 18 in. of air to the steel cross-arm. Company engineers are satisfied that they know the cause of flashovers and that a properly designed and installed bird guard is the remedy.

Synchronous Motors for Steel-Mill Drive

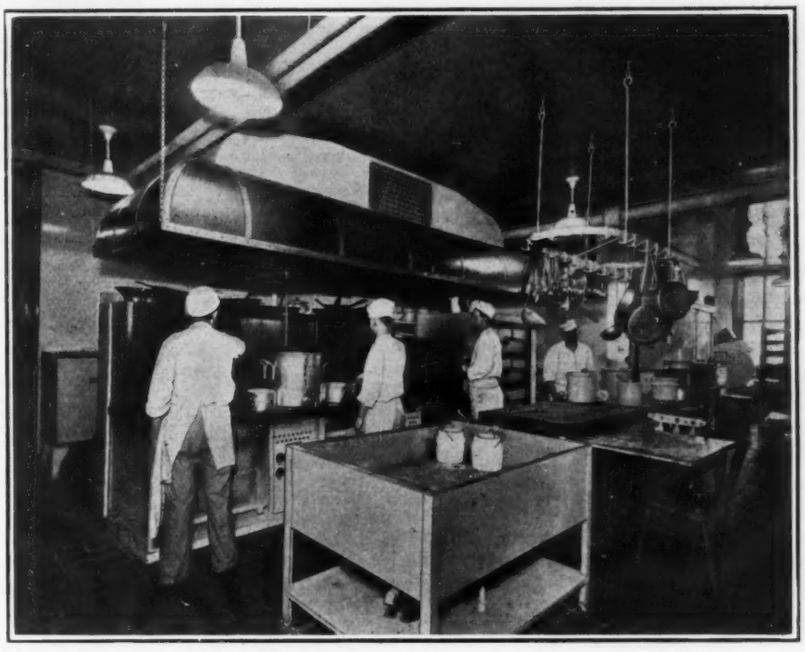
THE suitability of available designs of synchronous motors for steel-mill drives was discussed by S. H. Mortensen and R. W. Davis of the Allis-Chalmers Manufacturing Company before the Chicago Section of the Association of Iron and Steel Electrical Engineers on February 27. New designs of synchronous motors were described as having those essential features of steel-mill drives usually specified as ruggedness of mechanical design, high pull-out torque, satisfactory starting torque, high efficiency, high power factor, dynamic braking and speed suitable for direct connection. Test records were shown of recent steel-mill installations where motors with these characteristics have performed to the satisfaction of the mill operators and to the power company as well. A feature of the motor described by Messrs. Mortensen and Davis is the self-supporting short-circuiting ring for the squirrel-cage winding. This short-circuiting ring is supported directly from the rotor spider and by the proper choice of material can be made to give a great range of starting, accelerating pull-in and pull-out torques. There was presented a record of pull-out torque as high as three and six-tenths times full-load torque.

An important feature available with synchronous motors is that of dynamic braking. Test records showed dynamic braking of sufficient power to stop the motor in 2.9 revolutions without the load connected and in 1.8 revolutions with the load connected to the motor.

Commercial Electric Cooking

Results of Seven Years' Selling Efforts in Chicago—Problems to Be Overcome—Competition with Other Fuels—Many Successful Installations Reported in Hotels, Restaurants, Bakeries and Other Establishments

COMPARED with the relatively slow growth of commercial electric cooking taken the country over, the record of the Commonwealth Edison Company in the sale of heavy-duty equipment to restaurants, hotels, clubs and apartment houses stands out as an example of possible development when intensive, specialized effort is applied. Seven years ago there was installed in Chicago a total of 26 kw. in commercial cooking load. Today there are 110 oven and range installations connected to the lines of the Commonwealth Edison Company, with more than 3,500 kw. of commercial cooking load. A few years ago the sale of a heavy-duty electric range was a great occasion. Within the past year a single installation of seven ranges and miscellaneous equipment totaling 300 kw. has been made.



COMPLETE ELECTRIC KITCHEN IN CHICAGO RESTAURANT
Bain Marie pan in foreground; two 16-kw. ranges, 10-kw. broiler, 10-kw. meat oven, 9-kw. stock kettles behind ranges

Commercial electric cooking, however, like charity, should begin at home, in the opinion of A. M. Lloyd, who is in charge of this development. Some time ago the Commonwealth Edison Company installed in its large employees' cafeteria a complete electric kitchen. This installation, beyond meeting the cafeteria requirements perfectly, has been of invaluable service as a demonstration exhibit for prospective customers. It is full-grown and able-bodied as may be judged from the fact that the cafeteria serves an average of 1,100 meals daily between 11 a.m. and 2 p.m., and if it were operated throughout the day, the electric kitchen could easily provide for 2,500 to 3,000 patrons. The installation includes the following electric equipment: Two 16-kw. heavy-duty ranges, one 10-kw. broiler, one 10-kw. meat oven, one 11-kw. bread and pastry oven, two 9-kw. stock kettles, one 8-kw. Bain Marie pan, automatic refrigeration machine, dough mixer, meat mixer, coffee urn heater and various small utensils found in the modern kitchen. The cooking load totals 90 kw.

SPEED AND CLEANLINESS

In this installation a separate meat oven is used and is found more satisfactory than if built into the lower part of the range as it stands high from the floor, requiring less stooping. It can be more easily equipped for rapid operation than can the ovens of limited dimensions built into the range. The chef, in commenting on the operation of the meat oven, said: "It is the best oven I have worked with in fourteen years—easy to regulate the heat, easy to handle the meat, so clean, no smell, no grease, no trouble at all." The electric broiler has proved very successful in Chicago, as it is fast and much cleaner than the fuel-fired broiler. The same can be said of the range and bake oven. The 11-kw. bake oven of this kitchen supplies all bread, rolls and pastry for the 1,100 meals a day. The 30-gal. stock kettles have proved satisfactory and have an average load of 3 kw. each, although equipped with 9 kw. for rapid heat. Mr. Lloyd reported that there had been less frequent redecoration of the kitchen—only once in two years—since the installation of electric equipment in his company's kitchen.

Equipment of some of the important Chicago institutions practicing electric cooking on a large scale may be briefly described as follows: The Drake Hotel uses brick-type ovens. The Edgewater Beach Hotel has used electric bake ovens for seven years and has recently installed complete electrical cooking apparatus in the new hotel unit. This institution installed and is still using the first electric bake oven in Chicago. The Chicago Athletic Association has a complete electric kitchen with two years of perfect operating record behind it. The load factor of this installation averages 60 per cent. The Belden Hotel has an electric kitchen installation of 300 kw. and 132 apartment ranges totaling 1,050 kw. Mercy Hospital has a range and bake-oven installation.

APPEAL OF ELECTRIC COOKING

In Chicago the appeal of electric cooking for hotels and restaurants has been based on the inherent advantages of electric equipment rather than on reduced fuel cost. The specific advantages of electric cooking

equipment as demonstrated by Chicago installations may be enumerated as follows:

Less Dirt.—Electric equipment entails less dirt from fuel, less dirt from waste gases, smoke and tar in fuel, and from clogging of burners.

Less Space.—Electric equipment occupies a minimum of space, and frequently an electric range installation will require fewer sections than a fuel-fired range. A great saving in space is effected compared with storage of solid fuel.

Less Waste Heat.—The high efficiency of heat conversion in the electric range and its over-all efficiency of 85 to 95 per cent result in much less heat being wasted than is the case with fuel-fired ranges.

Less Variation in Heat.—Electric heat is as constant as the voltage supplied. Heat from fuel-fired ranges varies with the pressure or rate of firing and also with the draft and burner conditions and the varying quality of fuel. Electricity in the kitchen gives the chef laboratory control of his heat.

Higher Quality of Product.—Better bread, rolls and pastry are produced in the electric oven than in fuel-fired ovens as a result of more uniform heat distribution and better heat control and absence of fuel gases. Bread baked in an electric oven invariably retains its natural moisture longer than if baked in fuel-fired ovens.

Lower Maintenance.—The installation in the kitchen of the Commonwealth Edison Company has called for no repairs in two years. A similar installation using gas ranges has averaged repair bills of $18 per month. The average monthly service calls for electric cooking equipment on the power company's lines have averaged less than 4 per cent of the number of installations.

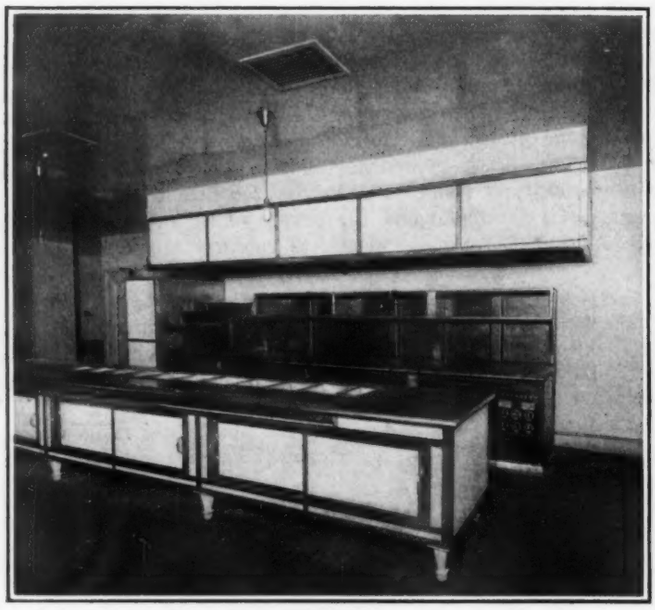
Advertising Value.—The public appreciates electrically cooked products, and the use of electric cooking equipment is of very considerable advertising value to the restaurant or baker. Baking companies have found it advantageous to print on bread wrappers the fact that their products are baked electrically. The installation of electric cooking equipment in one of the Chicago clubs resulted in a great many visitors and inquiries regarding the installation. The Commonwealth Edison Company has co-operated with the purchasers of their equipment in giving the electric installations adequate publicity.

Selling methods vary somewhat in different localities, but in Chicago the Commonwealth Edison Company has found it advisable to sell and service commercial equipment. Several concerns sell this equipment in Chicago, but the company has experienced better co-operation from the manufacturers since it has engaged in the

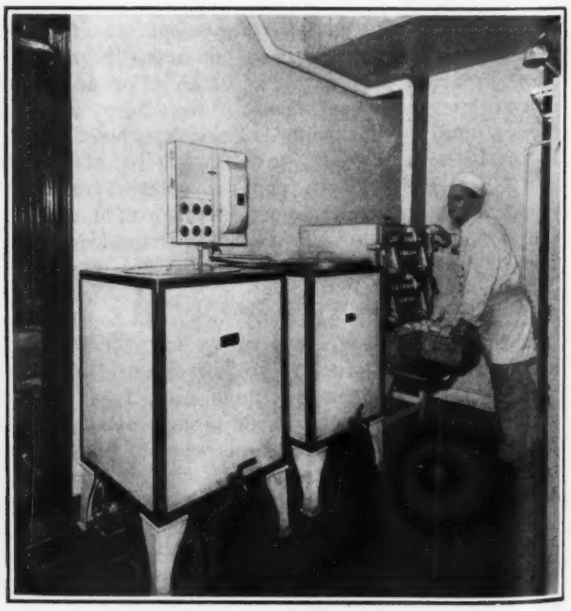
ELECTRIC EQUIPMENT FOR BAKERY
This establishment supplies bread, rolls and pastry for 1,100 meals daily; 11-kw. bake oven at right

sale of equipment. In Mr. Lloyd's opinion some companies might prefer to serve in a consulting capacity only and to refer inquiries to the manufacturer, but inasmuch as many of the equipment manufacturers can make fuel-fired equipment as well, it is most advisable for the central-station company actively to encourage the use and sale of electric cooking. Whether a company actually carries the equipment or not Chicago's experience indicates the advisability of the central-station's rendering some repair and maintenance service. Promptness is the most important element in the servicing of commercial cooking installation. The failure of service to a restaurant installation results in immediate and rapidly mounting losses to the owner. In such emergencies the central station is usually able to render service more promptly than the manufacturer.

Selling methods have changed somewhat with the growth of commercial cooking load both as a result of improved equipment and because of changes in the organization of large kitchens. In the early days considerable difficulty was had in securing satisfactory operation of the equipment. Now, however, such objections have been overcome, and the salesmen need have



98-KW. RESTAURANT INSTALLATION—THREE RANGES, MEAT BROILER



TWO 9-KW., 30-GAL. STOCK KETTLES; AVERAGE LOAD, 3 KW. EACH

no fear in recommending the standard products of reputable manufacturers. In the kitchen organization the chef formerly had the final say on a proposed electric installation. Lately in many institutions there has been established the office of purchasing steward, and this arrangement has enabled the central-station company to sell the electric cooking installation on its merits, and a prejudiced chef would be required to give the new system a trial. An interesting sidelight in developing hotel loads is found in the fact that the chefs and stewards of hotel kitchens are more or less jealous of their own accomplishments and disinclined to be influenced by the report or opinions of other men in similar positions. For this reason it is not always practicable, or tactful either, for the central station to capitalize on successful installations, as is frequently possible among other commercial and industrial customers. Inasmuch as most "prospects" for commercial cooking loads are already users of considerable light and power service, the cooking load, coming on the lower steps of a rate, is able to earn an average rate as low as, or perhaps lower than, the combined light and power load. This point may well be emphasized when talking with the prospective customer on the matter of the cost of fuel.

Commercial electric cooking load is particularly desirable to the central station because the load factor is as good as and often better than the average industrial load and it operates practically at unity power factor. The practical advantages of electric cooking have been demonstrated in hotels, restaurants, hospitals and clubs, and as demonstrated in Chicago with proper specialized support from the central-station company it can be made an important, steady, revenue producer.

Letters from Our Readers

A Criticism of Professor Herrmann's Conclusions on Power-Factor Rates

To the Editor of the ELECTRICAL WORLD:

Referring to an article in your issue for December 27, 1924, by Prof. R. R. Herrmann, I wish to call attention to the very apparent error under the heading of "Conclusions"—4(b). In the discussion preceding this paragraph it was tacitly assumed that a copper loss of 5 per cent at 100 per cent power factor existed. This was purely an illustrative assumption. In this conclusive paragraph 4(b) it is laid down as a *rule* that "the number of kilowatt-hours shall be increased by a percentage obtained by squaring the ratio of reactive to active energy and multiplying it by five."

To make this paragraph of even general appeal it should read to my mind: "The number of kilowatt-hours shall be increased by a percentage obtained by squaring the ratio of mean reactive to mean active energy and multiplying it by an integer number of what the copper loss would be at 100 per cent power factor." The word "mean" should be used with extreme care (mathematically speaking). It seems to me, furthermore, that the entire discussion of Mr. Herrmann applies, strictly speaking, to only short and minor commercial systems of practically constant load, since variable loads are inadequately treated, regulation and line characteristics entirely ignored.

Boston, Mass. GEORGE F. MARSTELLER.

The Proposed Embargo on Power Exportation from Canada

To the Editor of the ELECTRICAL WORLD:

The propaganda to induce the Canadian political authorities to prohibit the export of power from new hydro-electric developments has made considerable headway and gained converts in unexpected quarters. The reason appears to be that the prolonged industrial depression in Canada has produced a mental depression which is not conducive to the critical examination of propositions offered as panaceas. It is surprising how many persons appear ready to accept the assumption that if Canada prohibits the export of power American manufacturers will locate here in great numbers and create another era of expansion in all lines of business. Advocates of restrictions on the export of asbestos, tobacco, and even wheat, have appeared, and the embargo idea is being credited with all sorts of virtues.

No doubt the assumption that an embargo on the export of pulpwood would cause American manufacturers to develop newsprint production in Canada faster than they are now doing has a certain plausibility. Newsprint enters the American market free of duty. But newsprint production in Canada is already being developed at a rather tremendous rate, a rate that makes it unlikely that the artificial device of an export embargo on either pulpwood or power would cause American manufacturers to rush into an industry where the danger of overproduction is already a serious prospect of the near future.

When it is assumed that the prohibition of the export of power would cause American capitalists to establish in Canada a variety of other industries, the question where such industries would obtain a market for their products is overlooked. In very few, if any, cases would the advantages to be derived from proximity to Canadian power sites enable such industries to sell their products in the United States in face of the tariff. The new industries would have to find their major markets in Canada and to the extent to which they competed with established Canadian industries would merely augment the difficulties of the latter. Doubtless there are opportunities in Canada for industries now non-existent here. But the great trouble with Canada's existing industries is that they are overbuilt. Professor Leacock, head of the department of economics of McGill University, estimates that Canada's industrial equipment—such as it is—has a capacity equal to the demands of a population of twenty-five million. Many important industrial plants have been virtually idle since the post-war slump; few have been working to more than 50 per cent of capacity. The argument that an embargo on the export of power will result in the creation of many new industries in Canada financed by foreign capital will doubtless be weighed at its worth by Canadian manufacturers as soon as they come really to examine its implications. As one Canadian writer on economics points out, the embargo proposition as a means of attracting American capital involves the assumption that the United States is ready to open her markets freely to products from Canada or to annex the country.

Curiously, Premier L. A. Taschereau of Quebec advocates an embargo on the export of power while opposing an embargo on the export of pulpwood. His position is not logical, for the reason that about the only industry Americans could develop in Canada with the assur-

ance of a free market in the United States is that of which pulpwood is the raw material. It is highly probable that the Premier may find occasion to amend his views when the contagion of the fallacies fathered by the anti-export propagandists has spent its force. Senator Henry Miles, a promoter of the power project at Carillon Falls on the Ottawa River, openly charges members of the Quebec government with being unduly under the influence of Montreal power interests, which look askance at power projects that they do not control.

Enthusiasts are talking about the possibility of Quebec developing industries at a rate sufficient to utilize all its water-power resources within twenty-five years. That is a large expectation. The power available in the province is estimated at 12,000,000 hp. to 14,000,000 hp. At present the development is a little over 1,000,000 hp. And Quebec already utilizes a greater amount of hydro-power per capita than any other Canadian province. According to the Canadian Electrical Association, the Canadian consumption per capita per year is 820 kw.-hr., compared with 472 kw.-hr. in the United States and 700 kw.-hr. in Switzerland.

In the recent past new installations in Quebec have averaged 51,000 hp. per year. At that rate—which because of the inauguration of great paper-making enterprises is admittedly an abnormal rate—it would take Quebec nearly three hundred years to utilize all its water-power resources.

Obviously Quebec can develop manufacturing industries only in proportion as the available markets expand, and that fact, temporarily obscured by the propagandists, will eventually be the decisive influence in shaping the province's policy toward the export of power. Already the authorities of municipalities in western Quebec have taken Premier Taschereau to task for announcing a policy which would hold up the development of 500,000 hp. at Carillon Falls, a project that can be financed only on condition that the export of power is permitted.

C. MCKAY.

Montreal, Canada.

Fault Found with Cost Data of Giant Power Survey Report

To the Editor of the ELECTRICAL WORLD:

In your issues of February 21 and February 28 you make reference to the Giant Power Survey in the State of Pennsylvania. The writer has just received a copy of this report. He had expected that it would include a very careful estimate of the costs of building a modern power plant, modern transmission lines and the cost of their operation. When he came to page 43 of this report he found the following figures with no supporting data: (a) Cost of power plant, $75 per kilowatt; (b) cost of transmission lines, 20 cents per kilowatt-mile; (c) cost of operation, 3 mills per kilowatt-hour.

In a footnote to this table it is stated that these data were obtained from pages 9 and 10 of "Superpower Studies, Northeast Section of the United States, by the Northeast Superpower Committee." The writer does not have a copy of this report, but what struck him was that, on the basis of the cost of transmission lines being 20 cents per kilowatt-mile, a 1,000-kw. line would represent an investment cost of $200, whereas in Appendix E, on page 419, the cost of line for rural service, which will be of much less than 1,000 kw. capacity, is put at more than $2,000 per mile. He, therefore, began to check this report against the report made by the United States Geological Survey in 1921, entitled "A Superpower Estimate for the Region Between Boston and Washington," by W. S. Murray and others. This report was written by men thoroughly familiar with the subject upon which they were writing, and detailed estimates were made of the various factors involved. On page 17 of this report, under "Summary," it is stated that the reproduction cost under superpower operation for a power plant is $125 per kilowatt and that the average unit production cost for a superpower plant will be 9.9 mills per kilowatt-hour instead of the 3 mills per kilowatt-hour assumed in the Giant Power Survey report.

I feel, however, that the greatest discrepancy occurs under "B," concerning transmission costs, and to assume the figure of 20 cents per kilowatt-mile for an investigation of this kind is certainly taking a great deal of license with the ordinary method of attacking an engineering problem of a matter as large as the one in hand. Again referring to the superpower estimate report of 1921, on page 215 there is given an estimate of the cost of a 220,000-volt transmission line which is based on prices in the midyear of 1919. In this report it is stated that the cost of a single-tower line with two circuits of 220,000 volts is $27,328, and that of a two-tower line for four circuits is $54,056. Under "D," on page 44 of the Pennsylvania report, the costs are based on zones of 50 miles, so that a single-tower line with two circuits for 50 miles would cost $1,366,400 and would have a capacity of 100,000 kw. This is equivalent to 27.3 cents per kilowatt-mile, instead of 20 cents per kilowatt-mile, so that the figure assumed for the high-tension line is not so far off, but when applied to lines of lower voltage and capacity is very far off. However, if we assume 10 per cent carrying charges and 10 per cent loss, we get a total of 0.54 mill per kilowatt-hour for the first zone, instead of 0.2 mill per kilowatt-hour. This added to the probable manufacturing cost of 9.9 mills gives us as the cost of delivering power in the first zone more than 1 cent instead of 3.7 mills.

It is true a cost of 25 cents per ton is mentioned in this report for coal delivered to the plant, assuming that the coal will be produced in a byproduct plant, that the byproducts will more than take care of the cost of the coal, and that the owner of the plant will therefore furnish this coal to the power plant at 25 cents per ton rather than sell it to manufacturers who would be willing to pay him $1.50 to $2 per ton. It also assumes that there will be no expense for delivering this coal to the plant, although if the power plant and byproduct plant are adjacent to each other, some kind of conveying apparatus will have to be provided, and the cost of this conveying apparatus, together with its operation, will have to be borne by somebody. The writer is familiar with two power plants at mines where the distance from the farthest mine to the plant is only 6 miles, and yet the freight rate is 75 cents per ton, and it is assumed that with a byproduct plant of the size mentioned some of the coal would have to be brought a considerable distance. The writer is familiar with the byproduct plant at Clairton. This plant has a capacity of only 2,500 tons per day, or about one-third of that mentioned in the report, and yet the plant occupies a space along the river of more than 3 miles.

It, therefore, behooves any person desiring to use this report for general purposes to examine carefully the source of the data in the report.

J. B. CRANE.

The George T. Ladd Company,
Pittsburgh, Pa.

Central Station and Industrial Practice

Induction Furnace Produces Superior Brass

BY GEORGE C. HEISTERMAN
Power Sales Department, Public Service Company of Northern Illinois, Chicago

LOW metal loss and great uniformity of the finished product are features of a successful installation of induction furnaces for brass melting which has been put into operation at the plant of the Chicago Extruded Metals Company, Cicero, Ill. The installation includes a battery of Ajax induction furnaces of 66 kw. rating and hearth capacity of approximately 800 lb. each.

Operation of the furnaces is based on the induction principle, using 60-cycle, single-phase current in the primary winding and utilizing the metal of the charge as the secondary circuit. An iron core interlinks the two circuits and forms an integral part of the furnace structure. The raw material used in the furnaces consists of brass turnings, scrap and commercially pure metal. A motor-driven magnetic separator removes foreign matter from the brass turnings. Transformer action between the primary winding and the metal charge which constitutes the secondary causes heavy currents to flow in the metal. The metal is poured at 1,900 deg. F. Zinc is added to the bath just before pouring in order to reduce loss through oxidation. Approximately ninety minutes is required for melting and pouring a charge.

EXTRUSION PROCESS USED

Metal from the furnaces is poured in the form of billets approximately 6 in. in diameter. The billets are first heated in a muffle furnace at 1,000 deg. F and are then transferred to the extrusion press. This motor-driven press forces the metal through dies under a pressure of 4,000 lb. per square inch. From the press the extruded bars are passed through the draw benches, where the metal is reduced to its final dimensions. For small reductions no annealing is used, but for larger reductions some to as low as $\frac{1}{32}$ in., annealing of the metal between successive draws is necessary. Reductions in the draw benches are made in steps of $\frac{1}{64}$ in. or less.

The dies used on the draw benches are subjected to extremely severe service and are made of tungsten steel. The heat-treating of those dies is very important as they must be of absolutely uniform temperature throughout before quenching. Otherwise they would warp and vary from their designed dimensions. The heat-treating of the dies is intrusted to an electric furnace, which performs its function with complete satisfaction. The close temperature control, uniform heating and absence of contaminating gases in the electric furnace result in dies of rugged strength and accurate dimensions.

The finished product of the Chicago Extruded Metals Company consists of brass rods and shapes which constitute, in turn, the raw material for the manufacture of products of automatic screw machines. This product of the induction electric furnace has been found of superior quality and uniform grain structure. The low metal loss during melting has been a contributing factor in keeping down the cost of operation. Furthermore, the use of electric meters in connection with the furnaces permits of accurate knowledge of operating conditions and operating costs.

Electrical energy for this installation is supplied from the 12,000-volt industrial feeders of the Public Service Company of Northern Illinois as three-phase, 60-cycle, 440-volt service for the use of motors and furnaces.

Metering Unbalanced Loads on Transformers

BY W. F. WALSH
Meter Supervisor Kingston (N. Y.) Gas & Electric Company

VERY often it is necessary to take a 110-volt load from a 2,200/220-volt bank of power transformers supplying a large consumer. The question of metering is one either of primary or secondary. If the energy consumed by the transformer bank is of no great moment, the secondary metering method is used. However, if the transformer losses are to be included in the kilowatt-hours measured, a meter is connected ahead of the transformer bank.

ANALYSIS OF POWER CONSUMED FROM UNBALANCED BANK OF TRANSFORMERS

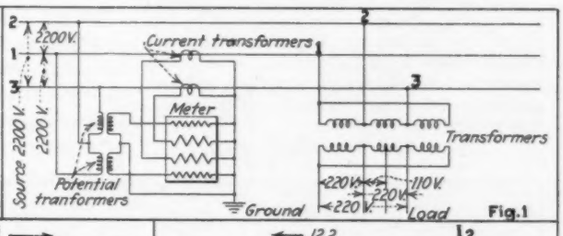


Fig.1

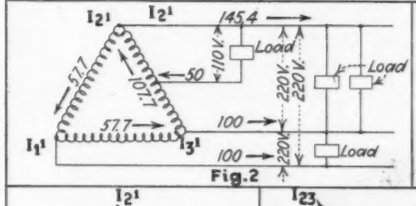


Fig.2

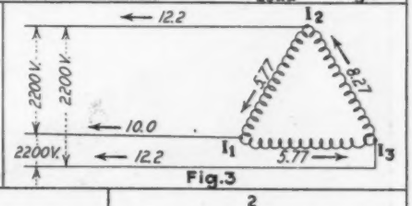


Fig.3

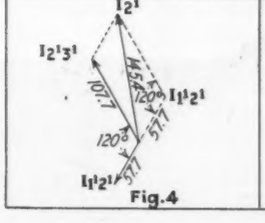


Fig.4

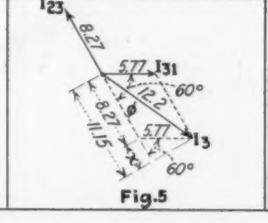


Fig.5

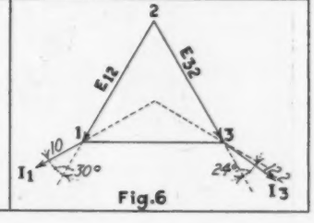


Fig.6

ANALYSIS OF CURRENTS

It is very interesting to know just what values of resultant current, primary and secondary, will flow under such a load condition, and this article shows in detail a method of obtaining these values. It also shows the phase relationship of the current and voltage measured by the primary meter.

Fig. 1 illustrates a method of connecting a primary meter to its current and potential transformers and also a bank of three 25-kva. power transformers delta-connected with a 110-volt tap taken from the secondary of one of them.

Assume the conditions to be as follows:

A secondary three-phase balanced load of 100 amp. at 220 volts; a secondary single-phase load of 50 amp. at 110 volts; a power factor of 100 per cent (to simplify the equations).

The total power exclusive of transformer losses will then be:

	Watts
100 amp. x 220 volts x 1.73.....	38,060
50 amp. x 110 volts.....	5,500
Total	43,560

The problem is then to prove that the meter actually measures 43,560 watts.

The secondary voltages and currents in the transformer windings and in the lines are shown in Fig. 2. In a delta-connected bank the current in the winding is equal to the line current divided by 1.73. Therefore, as shown in Fig. 2:

$$I_{1'2'} = 100/1.73 = 57.7 \text{ amp.}$$

The primary voltages and currents in the transformer windings and in the lines are shown in Fig. 3. Primary-transformer winding current equals the secondary-transformer winding current divided by the transformer ratio. Therefore, in Fig. 3:

$$I_{1\,2} = 57.7/10 = 5.77 \text{ amp.}$$

To prove that the current in line $I_{3'}$ equals 145.4 amp.: Referring to Fig. 2, $I_{3'}$ equals $I_{3'2'}$ minus $I_{1'2'}$ vectorially. Lay out these component currents as shown in Fig. 4. It will then be seen that the angle between $I_{1'2'}$ and $I_{3'2'}$ is equal to 120 deg., and the value of $I_{3'}$ can be determined from the law of cosines.

Then, referring to Fig. 4:

$$I_{3'}^2 = I_{3'2'}^2 + I_{1'2'}^2 - 2(I_{3'2'} \times I_{1'2'}) \cos. 120°.$$

$$I_{3'}^2 = (107.7)^2 + (57.7)^2 - 2(107.7 \times 57.7) (- 0.5).$$

$I_{3'}^2 = 21{,}142.87$; or $I_{3'} = 145.4$ amp.

On phase from I_1 to I_3 the primary power is the same as the secondary power, which is

$220 \times 57.7 + 110 \times 50 = 18{,}194$ watts

Therefore $I_{3\,2} = 18{,}194/2{,}200 = 8.27$ amp.

Referring to Fig. 3:

$$I_3 = I_{3\,1} - I_{2\,3} \text{ vectorially.}$$

Laying these out as shown in Fig. 5:

$$I_3^2 = (5.77)^2 + (8.27)^2 - 2(5.77 \times 8.27) (- 0.5).$$

$I_3 = 12.2$ amp.

Having found the value of current which flows in the primary line I_3, it is necessary to find the angle of displacement between I_3 and $E_{3\,2}$. This is done as shown in Fig. 5:

Cos 60° = $x/5.77$.

$x = 5.77 \cos 60° = 2.88$.

Now $\cos \phi = 11.15/12.2 = 0.913$.

Therefore the angle $\phi = 24$ deg.

Referring to Fig. 6, it is now possible to compute the power metered in the primary. Voltage $E_{1\,2}$ goes with I_1 and $E_{3\,2}$ with I_2.

The upper element of the meter shown in Fig. 1 will then measure:

$2{,}200 \times 12.2 \times \cos 24° = 24{,}508$ watts.

The lower element measures

$2{,}200 \times 10.0 \times \cos 30° = 19{,}052$ watts.

The total is 43,560 watts, which is the amount of power being drawn from the bank exclusive of transformer losses.

Preserving Faulty Concrete

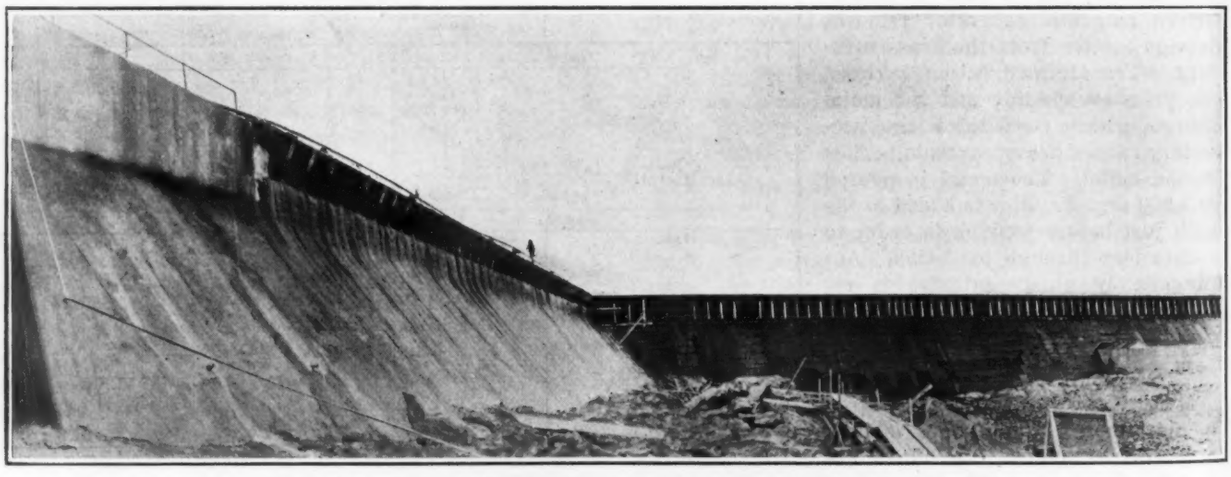
BY JOHN V. SCHAEFER
President Cement-Gun Construction Company

A RATHER unusual piece of work in solidifying and protecting against further damage a heavy concrete structure is shown in the accompanying illustrations. The success which has attended this effort is another argument in favor of concrete in that it shows that inherent defects in a mass concrete structure can be remedied even under extremely adverse conditions.

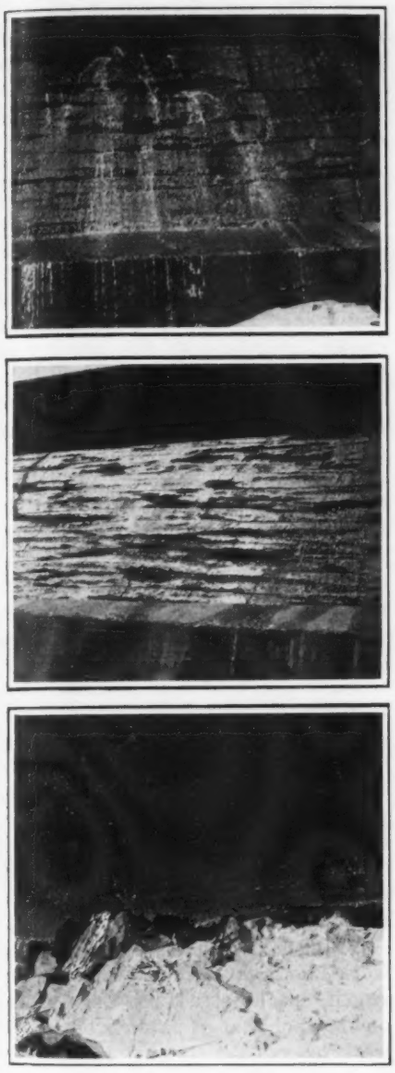
The diagram shows a cross-section of a gravity concrete dam across the St. Croix River in Maine. For purpose of water-level control concrete brackets 5 ft. apart and 10 in. thick were cast on top of the main structure on which 2-in. x 10-in. planks were laid loose. There was always more or less leakage through the cracks between these planks, which was in part stopped by throwing boiler cinders into the water and allowing them to silt up the cracks.

Owing to the difficulties met in constructing this dam in extremely cold weather there were inherent defects in it which permitted a large amount of leakage through the body of the dam. This ranged in volume all the way from a trickle, due to seepage, to actual streams spurting out to some distance. The action of frost during a period of years on both the water coming through the "flashboards" and running down over the downstream face and the water coming through the body of the dam was such as to tear away large parts of the concrete on the downstream face. This damage became progressively worse every winter. Investigation by a diver showed no such deterioration on the upstream face, which was continuously under water below the bottom line of flashboards.

The first thought was to fill up the holes on the downstream face and then cover the surface with a smooth facing by means of cement guns. Obviously this would have been a



GRAVITY CONCRETE DAM SOLIDIFIED AND PROTECTED AGAINST FURTHER DAMAGE
Section from left to center of illustration has been completed



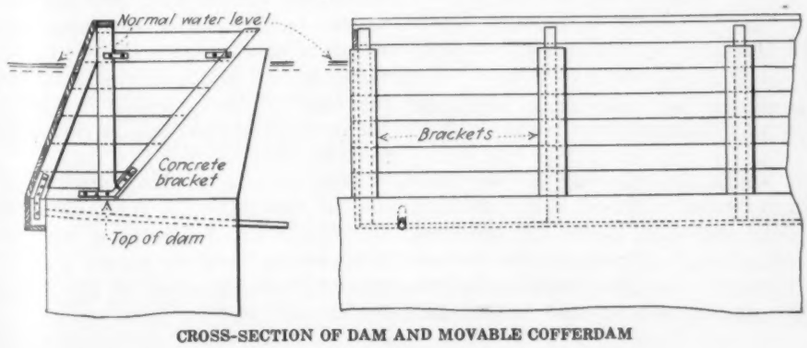
LEAKS AND SEEPAGE BEFORE WORK STARTED

temporary expedient of very questionable value so long as the body of the dam was saturated with water. This water would freeze and push off the concrete facing. To unwater the lake above the dam was unwise, and to cofferdam the upstream face was a matter of extreme difficulty owing to the water-logged timber and other rubbish that had accumulated. It was decided to try to solidify the body of the dam by impregnating it with cement grout. One of the difficulties anticipated was the matter of slime which covered the downstream face and extended into the cracks and crevices to an unknown depth. This slime would have to be removed before the impregnating cement or grout would bond to the old concrete. Another difficulty was the stoppage, on the downstream face, of leakage through the flashboards.

A movable cofferdam was built in 16-ft. sections and floated into place. The pressure of the water held it firmly in place after removing the flashboards, and what little leakage there was through the cofferdam was gathered into the gutter and piped free of the downstream face with a 2-in. iron pipe. By a process of impregnation under heavy air pressure the structure was first cleared of slime with a weak solution of potassium permanganate, which almost instantly oxidized the slime wherever found, leaving clean surfaces. Cement grout with various admixtures of accelerating or retarding compounds was then forced in until the downstream face was entirely dry.

The dam consisted of two wings at right angles to each other, one about 300 ft. long and the other about 1,200 ft. long. The short leg of the dam was worse than the long leg, and it was treated first. The grouting process was continued until all leakage and seepage stopped, so that the downstream face was dry. Reinforcing mesh and rods were then secured to the face by means of anchor bolts. "Guncrete," consisting of one part Portland cement and three and one-half parts of sand, was then "shot" in place, filling all cavities and coating the entire surface as shown in the illustration.

Before applying the "guncrete" it was quite definitely shown by various investigations that porosities, cracks and crevices were definitely filled and sealed. It is believed therefore that not only is the downstream face thoroughly protected against further action of frost due to penetration of water flowing over the downstream face through the flashboards, but the body of the dam is now thoroughly solidified and truly monolithic.



CROSS-SECTION OF DAM AND MOVABLE COFFERDAM

Saving Oil Breakers in a High-Tension Double-Bus Layout

BY E. A. CRELLIN*

FOR several years the Pacific Gas & Electric Company has been using a standard arrangement of buses in the 60-kv. and 100-kv. substations which affords all the flexibility of a double-bus arrangement and at the same time effects a material reduction in the investment in oil circuit breakers.

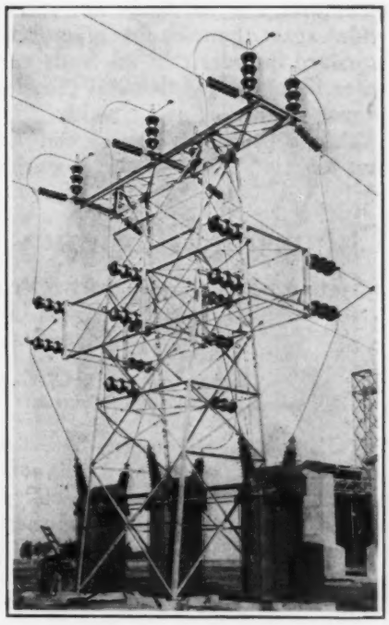


FIG. 1—STANDARD SWITCH TOWER FOR 100-KV. OIL CIRCUIT BREAKER

The conventional double-bus layout is shown in Fig. 2 and requires two oil circuit breakers for each feeder or transformer attached to the bus. The arrangement used by the Pacific Gas & Electric Company is shown diagrammatically in Fig. 3 and requires one oil circuit breaker for each feeder or transformer plus one extra oil circuit breaker for the entire bus. This latter circuit breaker is known as the bus-parallel-

*Assistant engineer, division hydro-electric and transmission engineering, Pacific Gas & Electric Company, San Francisco, Cal.

ing switch and may be substituted for any oil circuit breaker on the bus by transferring all circuits except the one fed by the switch to be taken out of service to one bus and feeding the remaining circuit off the other bus through the paralleling switch.

In order to accomplish this substitution of breakers, it is necessary to provide each oil circuit breaker with "by-pass" switches as well as "disconnecting switches," and a standard structure has been designed for this purpose. Fig. 1 shows a standard switch tower for a 100-kv. oil circuit breaker. The by-pass switch is mounted on the top of the structure and consists of a three-pole center-break switch operated from a single control. The disconnecting switches are on the sides of the tower and are all operated from a single hand-control lever. The oil circuit breaker is on the ground under the structure, and its tanks are spaced wider apart than the manufacturers' standard in order that the leads may enter in a straight line and preserve proper clearances at all points.

This arrangement has stood the test of time as regards operating convenience and at the same time greatly reduces the cost of the installation. The paralleling switch is provided with a separate panel on the switchboard and is equipped with a full complement of meters and relays corresponding to all other circuits. Thus it can replace any breaker on the bus which may be by-passed for inspection or repair and at the same time affords full protection for the circuit.

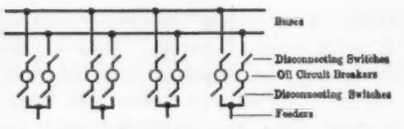


FIG. 2—CONVENTIONAL DOUBLE-BUS LAYOUT

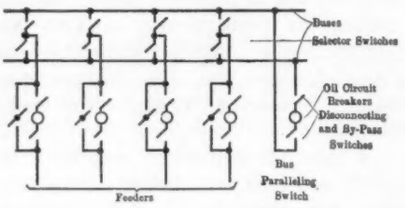


FIG. 3—DOUBLE-BUS LAYOUT WITH ONE OIL CIRCUIT BREAKER IN EACH FEEDER

Checking Efficiency by Man-Month Output

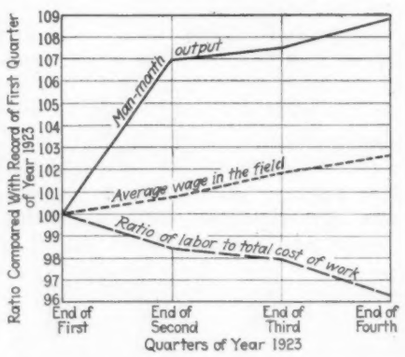
System Shows Comparative Production, Average Wage and Ratio of Labor to Total Cost of Work Carried Out in Distribution Department

BY R. E. CUNNINGHAM
Assistant Manager of Operation Southern California Edison Company, Los Angeles, Cal.

THE man-month output, or cost of work per man per month, is computed by the department of budget and expenditure of the Southern California Edison Company as a check on the efficiency of line gangs. This record is compared with the over-all expenditure in the district or division, as shown in the budget report.

The results of the analysis are gratifying from the viewpoint of comparison as may be seen from the accompanying curves. Although the number of gangs had been increased 20 per cent, which meant the breaking in of new men, it was found possible to make an effective showing through an increase in the man-month output of 8.86 per cent and a decrease in the cost of labor of 0.75 per cent in the face of an increase in the average wage in the field of 2.6 per cent. This record was made under the adverse conditions of rush construction, which would ordinarily increase costs.

Under this system the responsibility for the showing made by a line gang is more than ever vested in the foreman. He is primarily the unit on which the efficiency of the whole organization is based, and it is upon his co-operation, interest in the work and personal concern for the success of his men that the company depends for an increase in the output per man. The gang foreman is the first person to pass upon the capability of a man, and it is also up to him to see that safety and standards of construction are not sacrificed in order that a good record may be made.



HOW COST OF LINE WORK DECREASES WITH INCREASED MAN-MONTH OUTPUT

GANG FOREMAN'S WEEKLY REPORT BASIS OF STUDY

Since it is impracticable to keep a record of each man, the gang foreman's weekly report is made to cover each gang as a unit. Man-days are shown according to the number of hours worked, based on an eight-hour day constituting one man-day and twenty-six man-days equaling one man-month. The field clerk on the gang makes out a report which is turned in each week with information concerning man-days, labor, superintendence, automobile cost, and supply, transportation and tool expense—in short, the total operating cost of the gang. A monthly comparison is made of the total cost of work, number of man-months, man-month output, labor cost and the percentage of labor to the total cost. A summation of these monthly reports is made quarterly and annually, for purposes of checking. The manner in which the cost of line work decreases with an increase in man-month output is shown in the accompanying illustration.

Owing to the different classes of work in which various gangs are engaged, special stress has been placed on the fact that each gang of men is working against its past record only and not against other gangs.

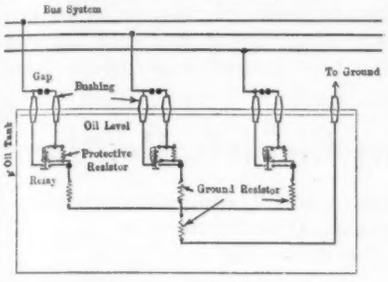
Comparisons are made only with previous reports of the same gang and the average records of other gangs doing similar work. These reports have shown variations to which considerable analytical study has been given to determine why a particular condition existed. The report places before the men in the field a record which enables them to make a comparison, resulting in a spirit of friendly competition and a feeling that it is only through their individual efforts that they can advance. A foundation has been laid which is watched with increasing interest by the men concerned, and the meaning of co-operation is being realized in a greater degree than ever before.

This subject is being studied by one of the technical committees of the Pacific Coast Electrical Association, and a detailed report will be presented at the close of the year's work.

Lightning Arrester of German Design

By JULIUS REUTTER
Brookline, Mass.

A LIGHTNING arrester which requires little space for installation and that has an adjustable critical voltage which may be kept very close to that of the line voltage has been used successfully in several power houses in Germany. All of



WIRING DIAGRAM FOR ARRESTER SUCCESSFULLY USED IN GERMANY

the apparatus is immersed in an oil tank with the exception of a horn gap mounted outside. The arc is introduced at this gap but interrupted in the oil.

In the event of excess voltage due to lightning the gap will be bridged and current from the line flowing over the gap will energize the coil of the relay, which is equipped with a protective resistor, and then pass on through the ground resistor to ground. The relays being closed short-circuits the gap, and the following discharge current passes through the discharge resistor to ground. By this time, the coil of the relay being de-energized, the relay opens and the arc is ruptured under the oil.

A recording device is connected with the relay in order to register the disturbance.

Benefits of Power-Factor Correction

THE experience cited below of the Herbrand Company, Fremont, Ohio, could not be incorporated, because of space limitations, in the article on power-factor correction by means of Fynn-Weichsel motors published in the February 14 issue of the ELECTRICAL WORLD on page 345. This company has been using a 120-hp. motor which has benefited operation in two ways. First, an improved power factor has been afforded the entire plant; second, smaller-sized motors could be and were installed, thus resulting in a saving in money in motorization. Besides this 120-hp. load in power-factor-correction motors, the company has about 350 hp. in squirrel-cage and wound-rotor induction motors. The motors are used in turning out the company's drop forgings, which range from pliers and wrenches to automobile axles.

Previous to the erection of the plant where the new motors are installed the company had been using static condensers on two-phase motors for power-factor correction. This brought the power factor in its old plant up to about 92 per cent. But when the new plant — which is not yet completed — was designed, the engineering department, according to Ralph H. Tyler, general superintendent, made an investigation to find what other means of power-factor correction could be used advantageously. This investigation showed that a single large synchronous condenser could improve the power factor up to and above the 85 per cent required by the Ohio Public Service Company, but the extra investment would be heavy. Because of the character of the work (heavy drop forgings) production schedules were not so closely related to proper motor speeds as to the ability of the motors to stand up under severe punishment. As a result of installing these new motors, the monthly power factors since May, 1924, have increased as shown in the accompanying table.

INCREASE IN POWER FACTOR AT HERBRAND COMPANY PLANT

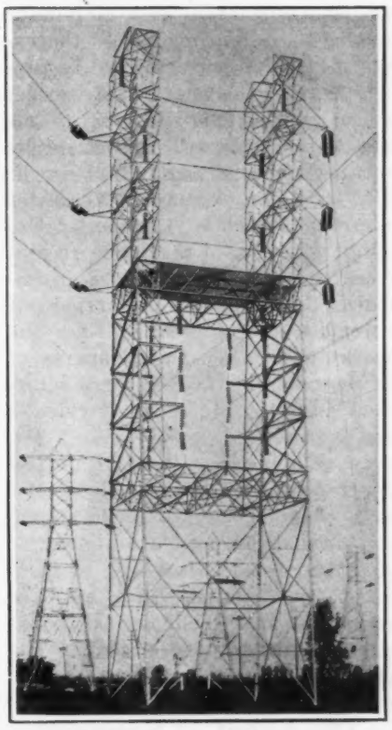
Month	Per Cent Power Factor*	Remarks
May	62½	Low power factor due to low load by using blowers only.
June	53	
July	59½	
August	78	
September	87	Energy consumption of 82,554 kw.-hr. for September.
October	87	

*The power-factor readings are weighted weekly averages.

The aim of the management is to have the motor load equally divided between Fynn-Weichsel motors and regular induction types. When this is accomplished, the Wagner Electric Corporation guarantees a power factor of 95 per cent or better. Some evidence of this possibility can readily be obtained from the fact that during October, when 120 hp. in power-factor-correction motors was operated, the power factor was raised to 87 per cent. Some of this increase can be accounted for by the good load factor on the air compressor. The new motors are now operating with an appreciable leading current, although no engineering tests have been made to check the amount, because the motors are not running at their full rated load.

"The operation of the Fynn-Weichsel motors has been very satisfactory up to date," declared Thomas Karlovetz, chief engineer. "As the plant grows we are to install these new motors on all blowers, thus making these installations standard. Because this equipment is going into a brand-new plant it is hard to determine the tangible saving over a similar installation with other types of motors, but we do know that we are operating with smaller-sized motors, improved power factor and with no production schedule losses."

Cross-Over Tower of Interesting Design



WHERE the 165-kv. transmission line of the Great Western Power Company crosses two 110-kv. circuits because of the diverging of the lines the special cross-over tower shown in the accompanying illustration is used. The 165-kv. circuit may be seen on the top of the tower and the two 110-kv. lines in the space below. Any possibility of the lines getting together and tying up the major source of supply of the system is prevented by the steel grating shown just below the higher voltage circuit.

Commercial Activities and Public Relations

Correction of Radio Interference

EFFORTS of electric light and power companies to locate and correct line troubles capable of interfering with broadcast reception of radio programs is shown in the work which is being done by central-station men in New England. For the past two years James A. Vahey of the maintenance-of-lines department of the Edison Electric Illuminating Company of Boston has devoted a large amount of time to helping solve problems of radio interference by power systems, and a national committee interim report (inductive co-ordination, N. E. L. A.) will be in print in a month or so discussing what has been accomplished by Mr. Vahey and his associates. Mr. Vahey has called attention to the importance of radio as a stimulator of long-hour lighting use to the extent of 20 to 50 per cent, and he predicts that in the near future socket devices will supply the energy required for tube-set operation by central-station service.

R. H. Alton, manager Worcester Suburban Electric Company, Uxbridge, Mass., said that upon receipt of complaints of interference an immediate investigation is carried out to remove the difficulties. On the theory that "when the pleasures of the customer in the home are interfered with by defective service a very sore toe is stepped upon," Mr. Alton or a member of his staff frequently carries a high-grade receiving set around the system in a company's car in order more quickly to locate and remedy leakages of insulators, tree grounds, etc., and the prompt service rendered is thankfully accepted by the company's customers.

The Spirit of Service

AS AN example of the extent to which a central-station company will go in the effort to please its customers, the Puget Sound Power & Light Company of Seattle recently hired an ocean-going tug, the *Roosevelt*, of some 800 hp., equipped it with a steam generator and tied it to a wharf on Vashon Island to maintain service there, after the company's submarine cable connecting the island with the mainland had been damaged in a storm. The expense of chartering this vessel and providing her with the needed equipment represented an outlay of many times the revenue that could be collected from the island consumers.

It is this sort of thing that has always distinguished private initiative and that in the end accounts for the great expansion of privately owned public service corporations. It is this spirit of service that wins in the long run, and the fact that it is disassociated from thought of political expediency accounts in a large measure for the ability of private companies to maintain the lead that their initiative has given them.

Customers Told About Electric Heating

Primarily Planned for Power Salesmen and Arranged to Interest Prospective Users of Equipment, Heat Lectures in Chicago Produce Good Results

BY EMERSON A. ARMSTRONG
Power Engineer Public Service Company of Northern Illinois

THE Public Service Company of Northern Illinois and the Commonwealth Edison Company of Chicago recently conducted a series of industrial electric heating lectures, which was briefly described on page 521 of the ELECTRICAL WORLD for March 7, with the intention of educating their own power salesmen and other men who come in contact with industrial customers.

INDUSTRIAL ELECTRIC HEATING

will be the subject of a series of lectures being arranged for the Power Salesmen of the Public Service Company of Northern Illinois and the Commonwealth Edison Company. These talks will be given by the foremost heating engineers of the country.

Realizing that many heat users would also be interested in these discussions, the plans have been rearranged, and the meetings will be held in the rooms of the

Western Society of Engineers
53 West Jackson Boulevard

Dates: January 23 and 30 and February 6—1 to 5 p.m.

You will be welcome

INEXPENSIVE BUT EFFECTIVE MAILING PIECE ANNOUNCING INDUSTRIAL HEATING LECTURES

While arranging the program it was realized that the talks should be as interesting to customers as to the utility sales forces, and consequently an announcement postal card, followed in a few days by a detailed program, was sent to all industrial power customers of the two companies with a connected load of over 25 hp. It was also sent to members of the Western Society of Engineers, to local members of the American Society of Steel Treating, the American Electrochemical Society and the American Iron and Steel Electrical Engineers.

On page 1 of the program was the following statement. It was without a heading and was signed by the electric heating divisions of the two companies:

A series of discussions primarily planned for the education of central-station engineers and salesmen, later enlarged so as to perhaps be of interest to certain of our customers.

As a heat user you may be interested in obtaining information that pertains to certain of your present and prospective problems, and you are therefore cordially invited to attend or send representatives.

Considering these mailing pieces from an advertising standpoint alone, it is believed that they paid for themselves at least, because most of the 3,500 of each mailing were probably given one reading, which could not fail to impress the reader with the fact that industrial electric heating has become a practical and proved method in many varied lines.

SPEAKERS AND SUBJECTS

J. G. Learned, vice-president of the Public Service Company of Northern Illinois, opened the first meeting and explained the object, which was to familiarize power salesmen of the two electric service companies with the many applications of electric heating which are already highly successful and to impress upon them that it is one of the most serious mistakes to make an electric heating installation where

some other form of heat would be more economical, because of the reaction on industrial electric heating business in general.

Wirt S. Scott, manager of the industrial heating division of the Westinghouse Electric & Manufacturing Company, had for his subject, "Electric Heat Treating and Industrial Processes," and he reiterated the importance of applying electric heating service only where it is economically correct.

A. H. Vaughan, chief designing engineer of the Electric Furnace Company, discussed the subject of "Where the Electric Heat Treating Furnace Is Economically Right" and emphasized the fact that in comparing electric heat costs with those of other forms of heating the basis must be the cost of treatment of the unit article delivered in an acceptable condition.

On the second day C. L. Ipsen, chief designing engineer, electric heating division, General Electric Company, under the subject "Some Interesting Electric Heating Installations with Operating Economies," gave detailed cost figures and illustrations of how electric heat had been used.

H. E. Brommer of the Pittsburgh Electric Furnace Corporation detailed the progress made in the application of electric arc-melting furnaces, showing that in melting the more common as well as the more expensive grades of iron these furnaces are more generally used than many persons in the electric service industry realize. This has been due to savings by the reduction of losses of alloys and the re-refining action which the arc furnace has in reducing sulphur in scrap iron.

Three speakers were on the program of the last meeting. Mr. McVicker of Young Brothers Company referred to electric ovens for japanning, drying and core baking, emphasizing the possibilities which are only now beginning to be recognized in the application of electric heat to core baking. As castings become more intricate the importance of good cores increases, because of the increase in labor wasted in "rejects."

Frank Weiser of the Hevi-Duty Electric Company discussed and illustrated some "Production Problems with Continuous and Automatic Electric Furnaces," taking up with these items the possibilities of recuperative and counterflow furnaces and other details of furnace construction.

Prof. C. F. Hirshfeld, chief of the research department of the Detroit Edison Company, summed up present conditions and the probable future under the subject of "Industrial Electric Heating."

The whole program was designed as a résumé of industrial electric heating progress up to the present time with each talk covering the practical applications of its particular phase. Discussions were broad and disclosed a great deal of interest on the part of prospective customers, not only in the more common applications, but in special equipment. Several successful installations were pointed out by customers, and this was most effective in interesting new "prospects."

The cost of the three meetings was as follows:

Printing	$206.00
Rooms, motion-picture machine and operator	75.00
Mailing	45.00
Miscellaneous	11.94
Total	$337.94

Considering the series of lectures as a whole, it is felt that it was highly effective and inexpensive in comparison with other methods of advertising and education. There was an attendance of sixty-nine customers and ninety employees, divided about equally between the three meetings, with eighty-seven representatives from other utilities and manufacturers.

"Selling the Company" by House-Wiring "Ads"

A DECISION was recently made by F. A. Gallagher, Jr., manager lighting division Narragansett Electric Lighting Company, Providence, R. I., to vary the type of house-wiring publicity which had been used in the local press for a number of years and to present the appeal along the line of "selling the company" in connection with house-wiring offers. The advertisements reproduced herewith form a series picturing to the householder some of the resources in central-station plant which lie "back of the button" and emphasizing the company's efforts to keep step with progress in order that the consumer may enjoy better and more efficient service.

Assuming that it is worth an equal amount to educate utility salesmen and to educate customers, the total cost distributed over 159 employees and customers was $2.12 each—a very moderate cost for the good accomplished. From another angle the cost of gaining each customer's attendance was $4.35 and the lectures were given at an expense of a little more than $1 per hour.

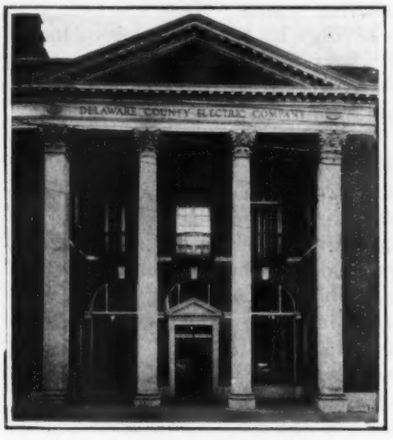
As a result of these meetings the Commonwealth Edison Company and the Public Service Company of Northern Illinois are considering holding similar meetings on this and like subjects periodically.

Ample Salesroom Facilities for Central Station

THE importance which central-station companies attach to adequate facilities for the display and sale of household appliances, lamps and other electrical merchandise is well illustrated in the new office of the Delaware Electric Company, the chief subsidiary of the Philadelphia Electric Company at Chester, Pa. Three views showing the display windows, appliance and lamp salesrooms of the office are reproduced here.

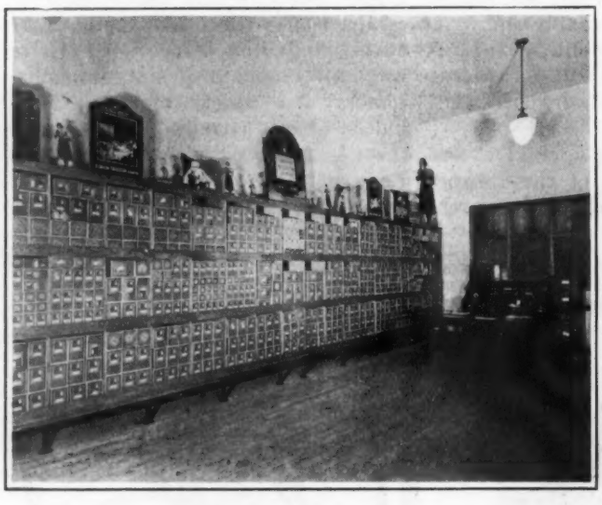
Four display windows, two of them being of inset type, have been provided. The greater part of the first floor has been given over to use as a display room. The rear of the display room contains the cashier's department, the counter being patterned along the lines of a bank, while the screen is of armored steel. At the extreme rear of the first floor is the lamp exchange department.

The second floor, accessible by both elevator and stairway, houses the general offices. Private offices of A. R. Granger, vice-president and general manager, and L. C. Smith, his assistant, and a waiting room occupy the front portion of the second floor. On the same floor are the business offices, rest room and telephone room. The basement contains storage room, repair shop, locker rooms, etc.



DELAWARE ELECTRIC COMPANY'S NEW CHESTER OFFICE

Showing four display windows and provision inside for appliance and lamp sales.



Electric Refrigerators Increase Rental Values

IN SELLING seventeen electric refrigerators for a new apartment building in Eau Claire, Wis., a successful appeal to the owner was made by the Northern States Power Company on the basis of greater cleanliness, reduction in wear and tear on buildings, elimination of drain-pipe trouble and increased value of apartments. The greater cleanliness and efficiency of the electric refrigerator compared with the ice box are easily appreciated by the average renter of an apartment, and the tenant as well as the landlord is generally favorable to any arrangement which will eliminate the dirt and mess caused by the delivery of ice.

Landlords are particularly interested in reducing wear and tear caused by the ice man passing through halls and stairways, bringing annoyance to tenants and dirt into the building. Owners also want to eliminate trouble from the clogged-up drain pipes, which generally results in damage to the plaster and decorations of the apartments below.

In selling the Eau Claire installation emphasis was placed on the idea of making the apartment building up to date and demonstrating to the owner that the electric refrigerator should enable him to obtain $5 additional rental per month from each apartment and also reduce the expense for cleaning and redecorating the building to such an extent that the electric refrigerator installation would soon pay for itself. In addition to these sales arguments, the prospective purchaser was informed of the care and attention given by the Northern States Power Company to all of its electric refrigerator installations.

This company has recognized the unusual possibilities of electric refrigerators for the increased sale of energy without increase in plant investment and has found it advisable to leave no chance for dissatisfaction on the part of the customer through any lack of attention or systematic servicing on the part of the power company. B. F. Smith is manager of the company's electric refrigerator department.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Balancing Boiler-Room Heat.—JOHN BRUCE. — A five-part article on balancing boiler-room heat containing fourteen tables and six diagrams and charts. By means of a system of continual testing a continuous check can be kept upon the heat losses in each component part of the boiler-room equipment. The principal items of these heat losses are the various excess air components, unburned gases, high final flue-gas temperatures and unburned coal discharged to the ashpit. The proper relation existing between the various losses should be determined so that none will be reduced to such an extent as to increase unduly the values of the others. The progress in methods of boiler-room operation has made the determination of heat losses simple and precise, and it is through this matter of increased precision that opportunities for increased economy are less liable to be overlooked. Methods for balancing heat in boiler rooms are illustrated by a very detailed example.—*Electrical Review* (*England*), Dec. 26, 1924, and Jan. 2, 9, 16 and 23, 1925.

Three 70,000-*Hp. Turbines Installed at Niagara Falls.*—The article, which carries a number of illustrations, deals with structural and hydraulic rather than with electrical features. Two units have Moody draft tubes and one has a "hydraucone" draft tube. Methods had to be devised for handling pieces weighing nearly 600 tons and lowering them over the face of the cliff.—*Engineering News-Record*, Feb. 16, 1925.

Hydro-Electric Plant at Forshuvudsforsen, Sweden.—The first installment of this long and profusely illustrated descriptive article was noted some time ago in the Digest. Subsequent parts take up such specific features as trash racks, fish screens, gates and their operating gear, and finally turbines, generators and switching equipment. Two units have been installed and space is provided for a third. The generators are designed for 10,500/11,000 volts, 50 cycles, three-phase, and have a continuous rating of 6,500 kva. Since they operate at 83.3 r.p.m., the rotors have seventy-two poles. (A letter to the editor in the Feb. 27 issue questions the figures given for the efficiency of regain of the draft-tubes in this plant.) — *Engineering* (*England*), Jan. 23, Feb. 6 and 20, 1925.

Generation, Control, Switching and Protection

Selection and Testing of Oil Circuit Breakers for Large Rupturing Capacities.—W. H. GREGORY.—The selection of oil circuit breakers for the modern power station calls for the utmost caution, and the engineer must take into account the various conditions under which these breakers will operate and the possible short-circuit current they will be called upon to rupture. Various points that should be noted and taken into consideration when selecting oil breakers for a specified service are tanks and methods of supporting them, contacts, length of break, speed of opening, vents, mechanism and accelerating devices, bushings and oil. Each of these points is discussed by the author.—*Electrical Engineer of Australia and New Zealand*, January, 1925.

Switchgear Specifications and Tenders.—J. R. WILKINSON.—The author deals with some of the salient points of switchgear specifications and makes a brief examination of the two main types of specification issued. The first type is the full and detailed specification, in which every item is specified. The second type gives the size and function of the gear, location thereof, both electrical and mechanical, together with a few general notes, and it is left to the manufacturer to decide on the type of gear, methods of protection, etc.—The author points out the advantages and disadvantages of each type. — *Electrical Review* (*England*), Jan. 30, 1925.

Compound-Wound Rotary Converters.—T. ISHIYAMA.—The combined and inherent maximum output of the compound-wound rotary converter under constant-supply potential is discussed. The author shows what the maximum output can be by means of numerical examples covering existing machines.—*Journal of the Institute of Electrical Engineers of Japan*, No. 437.

Transmission, Substations and Distribution

Determination of the Parameters of Transformers and Asynchronous Generators.—L. M. PROLROVSKY.—The paper contains a very detailed mathematical study of different possible cases which may present themselves when the method of short-circuiting or that of the absense of load is used. From the mathematical point of view the problem presents four different cases. The mathematical discussion is illustrated by a few practical applications of the theory which were made in the electromechanical laboratory of the Polytechnicum of Petrograd. — *Electrichestvo*, No. 12, 1924.

Alternating-Current Low-Voltage Networks.—The increasing density of load in the congested areas of the larger cities has created the necessity for developing a system of alternating-current distribution which would compare in reliability with the direct-current networks commonly used in such districts. During the past few years several central-station companies in various parts of the country have been studying this problem and trying out various solutions. The sub-committee on alternating-current low-voltage networks of the electrical apparatus committee of the N. E. L. A. has prepared a serial report which gives a general survey of the requirements of the problem, the advantages and disadvantages of the different methods being estimated and the main difficulties which require future study pointed out. No attempt is made in the report to establish standards or make definite recommendations as to the best methods since the whole subject is still in the development state. — *Publication No. 25-1 of the N. E. L. A.*

Mechanical Characteristics of Transmission Lines. — II — Span Formulas and General Methods of Calculation.—L. E. IMLAY.—The present article first compares the sag as computed by the accurate catenary formula and by the parabolic and shows that the results are substatially the same of spans up to 1,000 ft. and that the parabolic formula is usually accurate enough up to 1,500 ft. The effect of variations of temperature and loading are then shown, and a partly graphic method is given for determining extreme sags and tensions. A chart shows relations between characteristic ratios for the catenary, from which length and sag can readily be found, given the unit weight, span and tension. Illustrative cases are worked out.—*Electric Journal*, February, 1925.

Units, Measurements and Instruments

Boiler and Turbine-Room Instruments.—This is a serial report of the sub-committee on boiler and turbine-room instruments of the prime movers committee of the N. E. L. A. The recent developments in turbine and boiler-room instruments are reported, and new adaptations of older instruments are described. A survey of CO_2 indicating and recording instruments has been made, and the results of this survey, together with a description of the apparatus used for checking the instruments, are contained in the report. Descriptions of the types of operating-result reports and methods used to check operating performance by the use of instruments which were received from thirty-two companies are summarized.—*Publication No. 24-84 of the N. E. L. A.*

Short-Circuit-Proof High-Voltage Ammeters.—G. KEINATH.—The considerable cost of current transformers for high-voltage ammeters accounts for the fact that ordinary electromagnetic ammeters are found quite frequently built directly into the high-voltage line. Such instruments are usually mounted high up, out of reach, and have for very high voltages special metal casings with rounded edges to prevent corona. It is seldom realized how grave a danger these instruments introduce in a station. The copper cross-section of their windings must, of necessity, be much smaller than the section of the feeder in which it lies, so that quick overheating of the coils in such instruments is unavoidable when heavy overloads or short-circuits occur. Passing, for example, twenty times rated current will raise the temperature of the average instrument within less than two seconds to 120 deg. C. A novel type of ammeter, described in this paper, eliminates this danger. It consists of a special "single-bar-primary" current transformer, built directly into the instrument itself. In outer appearance such an ammeter does not differ from any ordinary electromagnetic in-

strument. Having a very short iron core—that is, a high magnetic resistance—the secondary current will rise imperceptibly after a certain maximum current is exceeded. This characteristic protects the moving element of the instrument in case of heavy overloads. The author cites, as an example, that such an ammeter for 300 amp. remained in perfect condition after being subjected to current impulses of 114,000 amp. The new instruments are being built with scales for 15 amp. up to 500 amp. As the cross-section of the copper rod, acting as the primary of the inbuilt transformer, is the same as that of the feeder, there is no danger of overheating. The current transformer can be turned at will into any position desired, so that the same instrument can be used in a vertically or a horizontally running bus.—*Siemens Zeitschrift*, January, 1925.

Illumination

Shadow Effects and Resultant Loss of Illumination.—J. W. T. WALSH.—According to the author, there seems to be a general opinion that in a highly diffused system of lighting the introduction of dark objects causes no noticeable shadow and that, therefore, their presence can be neglected for all practical purposes and calculations of the flux required in a given type of room carried on without any regard to the presence of objects of this kind. The author shows by detailed data that this conclusion is quite fallacious and that its application may in certain cases lead to entirely wrong results.—*Illuminating Engineer (England)*, February, 1925.

Geometrical Calculation of Illumination.— Z. YAMONOUTI.—The author considers the illumination due to light from luminous sources of simple forms. Illumination can be treated as a vector, and the component illuminations enable one to calculate easily the illumination in the space. The total flux falling on a certain disk emitted from the source is obtainable by the use of component illumination. When both the source and receiving disk can be considered to be two circles on the same sphere, it is possible to calculate the total flux falling on the disk emitted from the source very easily.—*Research No. 148 of the Electrotechnical Laboratory, Tokyo, Japan.*

Heat Applications and Material Handling

Continuous Electrothermic Furnaces for Complex Ores.—T. M. BAINS, JR.—Two types of furnace for smelting zinc-lead-iron ores are described, "inclosed arc" and continuous resistor. In the former the charge is heated by resting on a ferro-alloy bath, neither the charge nor the vapors being subjected to the intense heat of the arc. In the other the retort chamber is heated by carbon resistors, the charge being in graphite cylinders.—*Engineering and Mining Journal-Press*, Feb. 7, 1925.

Electric Arc Welding in the Steel Industry.—W. L. WARNER.—In the steel mill the opportunities for utilizing the electric arc in repair work and for salvaging worn parts are numerous. Cases in which the arc-welding method may be employed for repair work on spindles, in machine mills, in the blooming mill, in foundry and furnaces, in the transportation system and in pipe lines are discussed.—*Journal of the American Welding Society*, February, 1925.

Electrophysics, Electrochemistry and Batteries

Storage-Battery Electrolytes.—G. W. VINAL and G. N. SCHRAMM.—Experiments have been conducted at the Bureau of Standards to determine quantitatively the effect produced by a wide variety of impurities on the rate of sulphation of storage-battery plates. Of those affecting the negative plate, platinum is one of the most deleterious, extremely small amounts, even 0.00003 per cent, causing rapid sulphation. Silver, copper and the nitrates are harmful also, though to a less degree. The marked effect of chlorine on both positives and negatives makes evident the need of care to prevent contamination of the electrolyte by sea water. Certain combinations are much more harmful than either constituent singly. Contrarily, sodium and magnesium sulphates, which are occasionally recommended for "improving" the behavior of the cell, are found to produce little or no effect. A suggested specification is given for purity of electrolyte.—*Journal of the A. I. E. E.*, February, 1925.

Storage-Battery Separators.—C. L. SNYDER.—The author outlines a method for measuring the resistance of storage-battery separators and gives the results of measurments on separators of several kinds of wood. The effect of thickness of the separators, the method of treating them and the effect of concentration and temperature of sulphuric-acid solutions on resistance and mechanical strength of the wood are described.—*Technologic Papers No. 271 of the Bureau of Standards.*

Traction

Electric Locomotives for the Norte Railway of Spain.—Abstracts of other articles describing these locomotives have previously been given in the Digest. The present article, which is illustrated, includes a table of dimensions and ratings.—*Engineer (England)*, Jan. 16, 1925.

Bond Testing and Maintenance Practice.—This article includes a tabulation of types of bonds employed, causes of failure, methods of testing and replacement standards, summarized for twenty-five electric railways.—*Electric Railway Journal*, Jan. 10, 1925.

Phase-Transforming Locomotives.—L. VEREBELY.—In the March 14 issue of the ELECTRICAL WORLD, on page 573, a Digest item on the above subject referred to an article in the Jan. 8 issue of the *Elektrotechnische Zeitschrift*. In the magazine credited below an article on the same subject appears. This article contains much more detailed information on the electrical features of the new type of phase converter and driving motors, with a large number of illustrations.—*Elektrotechnik und Maschinenbau*, Feb. 15, 1925.

Telegraphy, Telephony, Radio and Signals

Method of Measuring at Radio Frequencies the Equivalent Series Resistance of Condensers Intended for Use in Radio Receiving Circuits.—CHARLES N. WEYL and SYLVAN HARRIS.—The authors used a large adjustable rectangular loop, with dimensions of the order of 20 ft., in a resonant circuit, including the condenser under test, a shunted sensitive thermo-galvanometer and a known low resistance with removable short-circuiting strap. From the known or accurately computable resistances under two conditions and the corresponding ratio of currents the condenser resistance can be found. The circuit is loosely coupled and tuned to an oscillator giving a known frequency. For each setting of the condenser the current is then brought to the same magnitude. With this arrangement the authors find that the condenser resistance changes in an inverse relation to the capacitance. The results are given in tables and curves.—*Proceedings of Institute of Radio Engineers*, February, 1925.

Vibrating-Coil-Type Telephone Receiver.—K. KOBAYASHI.—The motional impedance measurements of the vibrating-coil-type telephone receiver used as a measuring instrument for acoustic study are described. Several of the factors of design necessary to obtain a satisfactory telephone receiver for this acoustic research are studied.—*Journal of the Institute of Electrical Engineers of Japan*, No. 437.

Miscellaneous

Engineering Cost Studies.—F. L. RHODES.—The author outlines the field for economic studies in engineering work, using illustrations drawn from telephone engineering practice. Although depreciation and current maintenance are important factors entering into engineering cost studies, they are not the only ones. Whether the necessary capital is at hand or it is necessary to raise it, the annual cost of the capital must be taken into consideration. Treatment of the matter of depreciation is, moreover, incomplete without consideration of salvage value and cost of removal.—*Bell System Technical Journal*, Vol. IV, No. 1.

Matter and Radiation.—Sir Oliver Lodge's presidential address to the Radio Society is reported at considerable length. It is a broadly philosophical discourse reviewing our present knowledge of radiations—ranging from the long ones used for radio communication to ether pulses smaller than the atom itself—their causation, propagation and detection. Solar radiation occurs, according to Jeans, at the expense of its own substance, by conversion of matter into energy. He suspected that we should ultimately find that the reciprocal action is also possible and that in the confines of space matter is being generated from radiation. He believe that the ether was under the enormous pressure of 10^{29} tons per square centimeter and that it was this pressure which held the electron together in spite of the self-repulsion of its parts.—*Engineering (England)*, Feb. 6, 1925.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Circuit Breakers, Closing Mechanism for

Improvements have been made in motor-operated mechanisms for oil circuit breakers in which a small vertical-type motor operates over wide variations of voltage both on alternating-current and direct-current circuits. It has a series characteristic which enables the mechanism to operate speedily and with great force at the beginning of the closing stroke. The fly-ball linkage driven by this motor gives a cushioning effect at the end of the closing cycle. — *General Electric Company, Schenectady, N. Y.*

Core Loss, Bibliography on

An extensive bibliography on core losses in electrical machinery has been compiled, containing about 1,250 references. A few copies have been distributed, and it is expected that a more general distribution will be made possible by its publication during this year.—*Core Loss Committee of the National Research Council, 33 West Thirty-ninth Street, New York City.*

Core Losses, Separation of

A study has been made and a method perfected for analyzing the losses in rotating machines. This method permits the separation of all losses and the forecasting of these losses with greater accuracy than has been possible in the past. This will allow for closer designing, with better proportioning of machines to insure maximum efficiency of operation.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Frequency Converter

When a rigid frequency tie is made (as in the case of a synchronous set) a fixed relation must be maintained between the speeds of the two systems so that if the frequency of one system changes from time to time, the other must make corresponding changes. Otherwise the set will pull out of step. Load transfer must be regulated entirely by setting the governors on the prime movers of the two systems and the set can be synchronized only by adjusting the speed of the two systems. During 1924 there was put on the market a type of frequency converter in which the foregoing operating limitations were overcome. This is known as the "Scherbius-controlled load-regulating" type of set. It consists of a synchronous generator directly connected to an induction motor, with a Scherbius speed-regulating set. This regulating set makes it possible to hold any desired load with the ratio of frequencies of the two systems at any value within the range of the equipment. The speed-regulating type of set does not require a fixed relation between the two system frequencies. It can remain connected between systems and deliver load in proper amount and direction with variations in system frequencies within the limits for which the set is designed. It can be arranged to hold constant load in either direction with speed variations of either or both systems by control of the set itself; that is, it does not require governor control of the prime movers of the two systems to regulate the load on the set. For details see *General Electric Review*, January, 1925.

Insulating Material, Molded

There has been developed a new form of insulating material capable of being molded very readily. It is made from a synthetic resin and in appearance resembles amber. It offers unusual strength as a bond in building up mica and other materials and has the further advantage of being capable of withstanding high temperature.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

In Progress or Purposed

Cables, Submarine, Insulated with Hard Rubber

Recent experiments seem to indicate that hard rubber may be more satisfactory for submarine telegraph cables than the usual gutta percha. The dielectric constant of hard rubber is lower; it is mechanically stronger at ordinary temperatures, and does not deteriorate in air. Hard rubber with the requisite flexibility and elasticity may be obtained by controlling the composition and conditions of vulcanization.—*Bureau of Standards, Washington, D. C.*

Brass Tubing, Internal Stresses in

In the tubes examined the major stress in the outer portion of the tubing is a longitudinal tensile stress, that in the inner part is a longitudinal compressive stress, the summation of the stresses being zero. Absence of circumferential stress is shown by the failure of diametrically cut rings to spring in or out on being slit in two. For measuring the longitudinal stress a narrow strip is slit longitudinally in a piece of tubing, *e.g.*, a strip 2.75 in. long and 0.10 in. wide in a 3.25-in. tube length. By releasing one end of such a slit strip by cutting, the stress is indicated by the springing out of the freed end. — *R. J. Anderson and E. G. Fahlman, Bureau of Standards, Washington, D. C.*

Circuit Breaker, Direct-Current, with Electrolytic Shunt

The main contacts are shunted by an electrolytic cell with an aluminum anode, so that during a short interval of time after opening the circuit breaker the current flows unabated through the cell, and then a rapidly forming layer of aluminum oxide virtually stops the current. The circuit is then opened by an auxiliary switch. For details see *Recherches et Inventions*, Dec. 1, 1924.

Lightning Generator

By means of the lightning generator in our high-voltage laboratory, a great deal of information in regard to the effects of lightning on transmission systems was secured. The experiments were conducted with artificial lightning on models of clouds, built to scale, the voltage of the lightning generator being about 2 per cent and the power about 0.02 per cent of natural lightning. This practically corresponds to the lightning energy that appears on transmission lines.—*General Electric Company, Pittsfield, Mass.*

Mercury Vapor Arc

Research is being continued on this type of arc, not only because of its practical applications, but also because the mercury arc is a valuable auxiliary in many experimental investigations. Various lines of study, with references to literature, are summarized in the *Transactions of the I. E. S.*, October, 1924, page 722.

Photo-Cell, Thermionic

A thermionic device with the output controlled by light is constructed for the purpose of using it as a photo cell. The device delivers several milliamperes and therefore can operate directly, without additional amplification, mechanical relays of medium sensitiveness. It consists of four electrodes —a filament of oxide-coated type, the first grid used as main anode, the second grid of finer mesh, in electrical contact with the silver-coated inside walls of the container, and the fourth electrode in the shape of a cylinder enveloping the whole structure. The inside of the bulb, with the exception of a window for the admission of the light, is coated with distilled alkali metal. The bulb may contain argon under low pressure. In operation the filament is heated to a low temperature, which, together with specially arranged shields, prevents the direct illumination of the light-sensitive coating by the filament.—*V. K. Zworykin, Westinghouse Electric & Manufacturing Company.*

Resistance, Electrical, as Function of Illumination

The electrical resistance of selenium is known to decrease with increasing illumination, and this property has been utilized in turning off beacon lights in the day time, in electrical transmission of photographs, etc. Experiments have shown that bismuth, copper and platinum manifest similar characteristics at the temperature of liquid air. Moreover, these results were first predicted from theoretical considerations.—*R. S. Bartlett, Yale University, New Haven, Conn.*

Springs, Tests on

A comprehensive set of tests on spring materials is being undertaken. The materials under test include the six materials suggested by the British Engineering Standards Association, together with three or four other materials. When the results of the test are known it is proposed to make springs of the same materials and test them both in the laboratory and on the road in order to correlate the results.—*National Physical Laboratory, London, England.*

Suggestions for Research

Acoustic Shock

A sudden electrical disturbance in a telephone system, usually caused by a failure of a paralleling power line, sometimes causes telephone operators a painful auditory shock, which may lead to prolonged nervous after-effects. There seems to be no method available at the present time for protecting an operator from the possibility of such a shock.

Insulators, Leakage Due to Soot Deposit

On telegraph and telephone lines closely paralleling the railroad tracks the insulators soon become coated with a deposit which adheres very firmly to the surface and under unfavorable weather conditions forms a path for current between wires on adjacent pins and from wire to ground, thus seriously interfering with communication. Exhaustive studies have been made relative to the removal and cleaning of insulators, and appreciable numbers of them have been so cleaned, but it has been found after careful analysis that the cost of removing, collecting, packing, shipping, cleaning, inspecting, repacking and installing amounts to more than the cost of new insulators, and they do not remain clean as long as new ones after being placed in service, apparently on account of the condition of the surface of the cleaned glass. It might be possible to develop either a material for the insulator, a new type, a coating which would be applied to the present insulators, or a method of cleaning in place that would overcome this trouble.—*J. C. Johnson, Pennsylvania Railroad, Philadelphia, Pa.* [Paraffin has a high surface-creepage resistance; perhaps coating a dirty insulator with hot paraffin will sufficiently restore its insulating qualities for the low voltages involved. Or else an insulator may be dipped in paraffin before being used. Then, after sufficient soot has accumulated on it, hot paraffin may be poured over it, melting and carrying away the old paraffin with dirt.—EDITOR.]

Shaft Behavior, Optical Study of

Rotating shafts are subject to disturbances that may interfere seriously with the operation of machinery. The disturbance generally consists of a whirling of the shaft in a bowed condition or a vibration of the shaft with nodal points at the bearings, one or both of these motions being superposed on the rotation of the shaft. For an optical method of study with the use of a motion-picture camera or a microscope see B. L. Newkirk, *Journal Optical Society of America*, 1924, Vol. 9, page 605.

Synchronous Machines, Detailed Tests and Theory of

Blondel's theory of two armature reactions is becoming of increasing practical importance as new problems arise in the design and operation of large synchronous machines. It is less generally known that of late years Blondel has extended this theory and developed some new tests for measuring the individual reactions and reactances. For the first accounts see *Comptes Rendus*, Vols. 158 and 159, and the *Revue Générale de l'Electricité*, Vol. 5. Later articles have appeared in these periodicals and in the *Bulletin de la Société Française des Electriciens*, to date.

News of the Industry

Wilson Dam Almost Ready

On July 1 120,000 Kw. Should Be Available—Secretary Weeks' Probable Action

INSTALLATION of the four main units of the power-generating machinery at the Wilson Dam has been virtually completed, General Harry Taylor, the Chief of Engineers, reported on March 16, on returning to Washington from an inspection visit at Muscle Shoals. While the switchboard is not ready, it will be completed by July 1, and 120,000 kw. of power will be available at the end of the dam on that date. No steps have been taken to provide transformers as Congress has made no provision for the possibility of disposing of any portion of the power at a distance.

Before leaving Washington after the inauguration for a short vacation trip, the Secretary of War said that he had given no particular consideration to the problems which must be worked out because of the failure of Congress to make definite disposition of Muscle Shoals. Secretary Weeks, it will be remembered, stated some months ago that he would not hesitate to make temporary disposition of the power under his custodial authority. There is no reason to believe that he has changed his mind. It is regarded as highly improbable that he would allow the plant to stand idle when the power could be sold readily for more than $1,000,000 annually.

The Southeastern power companies have to strain their resources every fall to tide over the period of low water. If there should be objection to a contract extending much beyond the time of the convening of Congress, it is believed the Southeast would be very glad to get the power to help out this fall, even if it cannot get it for a longer period.

A. I. E. E. Directors Nominate Ticket for 1925-6

At a meeting of the board of directors of the American Institute of Electrical Engineers held in New York on March 13 the report of the committee of tellers on its canvass of the nomination ballots cast for candidates for the Institute offices falling vacant July 31, 1925, was presented. As required by the constitution of the Institute, the board then selected by ballot its list of "directors' nominees," with the following result:

For president—Dr. Michael I. Pupin, Columbia University, New York.

For vice-presidents—District No. 2 (Middle Eastern), Arthur G. Pierce, Cleveland; District No. 4 (Southern), W. E. Mitchell, Birmingham; District No. 6 (North Central), Herbert S. Sands, Denver; District No. 8 (Pacific), P. M. Downing, San Francisco; District No. 10 (Canada), W. P. Dobson, Toronto.

For managers—M. M. Fowler, Chicago; E. C. Stone, Pittsburgh; H. A. Kidder, New York.

For treasurer—George A. Hamilton, Elizabeth, N. J.

The election ballots, including the names of the directors' nominees and all other eligible candidates, will be mailed to the membership prior to April 1.

Work of Investigating General Electric Begins Slowly

In conformity with the mandate of the Senate the Federal Trade Commission has begun work on the investigation of the General Electric Company, but no great amount of progress can be made until after June 30. The small staff of the economic division has about all it can do to complete other reports which must be in finished form prior to the end of the fiscal year. The report on the General Electric Company is not required until December 7—the date on which the next regular session of Congress will convene. While there is no tendency to condone legislative activities that interfere maliciously and meddlesomely with honest business, it is believed at Washington that this investigation is likely to stand the electrical industry in good stead. With the railroads too sick to attack and with "trust busting" in disrepute, politicians with proclivities toward the baiting of big business are expected to turn to the conspicuously prosperous electrical industry. There is a general realization that this industry is going to continue to be the target of political attack until the public is convinced that no grounds exist for adverse charges. A report from the Federal Trade Commission will have more weight with the public than all the statements which might come from the electrical industry itself.

Perhaps no other person in America has had such opportunities to study corporate management and large-scale business organization as has Dr. Francis Walker, the chief economist of the Federal Trade Commission, who is in immediate charge of the investigation of the General Electric Company. Dr. Walker, the son of the late General Francis Walker, one of the leading economists of his day, has had unusual opportunities in the course of his own work as an economist. His studies of trusts and combinations brought him to the attention of President Roosevelt and led to his appointment as a member of the staff of the Bureau of Corporations, which later was replaced by the Federal Trade Commission. Because of his long service with these agencies he has had an opportunity to see a mass of inside material which no other economist has had a chance to study.

Asks More Niagara Power

President Schoellkopf Holds that Treaty Revision Is Vital to State and Nation

A DEMAND for a revision of the international treaty governing diversion of water from Niagara Falls is embodied in the annual report of the Niagara Falls Power Company, just made by its president, Paul A. Schoellkopf. Pointing to the tremendous growth in the demand for electrical energy and to the limitations imposed on the further transmission of power from the Falls by the fact that substantially all the energy that can be generated at high efficiency with the use of the water now permitted has been sold, Mr. Schoellkopf continues:

"Only a small part, comparatively, of the potential energy continuously wasted in the downward sweep of the Niagara has yet been developed. The waters of the lower river are untouched. The 'over-all' development, with 300 ft. or more head, awaits only removal of the somewhat extreme diversion limitations imposed by the treaty. Substantial amounts of water could be diverted by either or both methods without injury to scenic Niagara. With proper remedial works, the proposed 300-ft. development could be vastly increased."

As to the enormous waste which the American-Canadian treaty limitations entail Mr. Schoellkopf says:

"Economic laws cannot long be withstood. It may be important to this company, but it is vital to the state and nation to discontinue the great economic waste of Niagara energy now, when as never before intensive and effective development of every available resource is imperatively required."

East Penn Merged with Pennsylvania Power & Light

As foreshadowed in the ELECTRICAL WORLD recently, the East Penn Electric Company, with headquarters in Pottsville, Pa., has been merged with the Pennsylvania Power & Light Company of Allentown. The East Penn Electric has generating stations at Palo Alto, Pine Grove and Williamstown, is capitalized at about $14,000,000 and reaches a population of 125,000. The Pennsylvania Power & Light operates in many central Pennsylvania cities, including Allentown, Bethlehem, Hazelton, Mahonoy City, Stroudsburg, Sunbury, Wilkes-Barre and Williamsport. It has steam generating plants at Hauto, Harwood, Wilkes-Barre, Williamsport, and elsewhere and contemplates building a large plant at Selinsgrove, opposite Sunbury. It has 408,441 capital shares without par value and bond issues of more than $20,000,000. The population served is 875,000. The East Penn Electric has been under the

management of the J. G. White interests, while the Electric Bond & Share Company is fiscal agent for the Pennsylvania Power & Light.

Silzer Takes a Hand

New Jersey Executive Has Plan to Regulate Interstate Transmission by Tri-State Body

A NEW plan for the regulation of interstate power transmission in the North Atlantic States was put forth last week in a special message sent to the New Jersey Legislature by Governor Silzer, who asked for authority to appoint a bipartisan commission of four to meet with similar commissions in the States of New York and Pennsylvania for the purpose of drafting a compact to regulate the service and rates of superpower companies which may transmit electricity from one of the three states to or across one or both the other states. The Governor's message suggested that his nominations to the commission be subject to Senate confirmation. In this way, the Governor asserted, the three states could regulate, without interference from the federal government, any great combinations which may be formed for the transmission of electrical energy from the Pennsylvania mines or from Niagara.

"If these large companies develop their plants and enter our state," he said, "and if, as the natural consequence thereof, combinations and agreements are made between the various companies from within and without the state, we shall soon find ourselves unable to regulate either the rates or the service. We shall be promptly told that since this current moves from state to state it is the subject of interstate commerce and only to be regulated by the federal government. Local companies and those from without the state will not long remain in competition. If they did, there would soon be a reduction of rates for electrical energy. After a short period of competition they will combine so as to prevent competition—then will come again an increase in rates.

"The modern trend is for these companies to get together, either by agreement or by combination and consolidation—then they will insist that the only way to regulate them is by appeal to the federal government. By that time we shall have lost our hold and control over them and it will be too late to act. It is quite apparent, therefore, that the states must come together for their mutual protection; that they must shake off federal control and regulation and assume that control and regulation themselves."

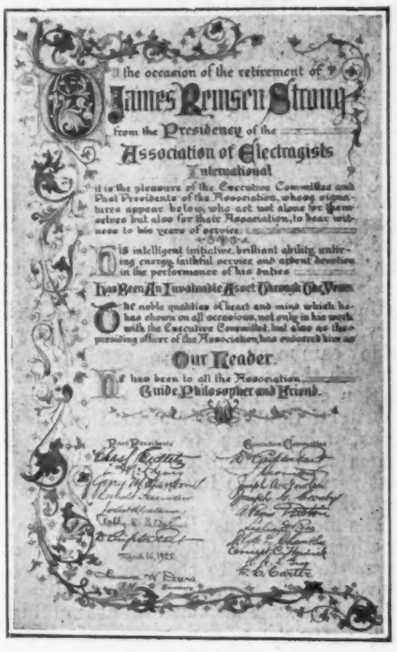
Utah for Six-State Ratification of Colorado Treaty

Utah has joined Colorado and Wyoming in passing the bill providing that the Colorado River treaty shall be binding whenever six of the seven states concerned and the federal government approve the compact. California, Nevada and New Mexico remain to be heard from.

Testimonial Presented to James R. Strong

As an expression of the high regard in which James Remsen Strong, retiring president of the Association of Electragists International, is held by his colleagues in the electrical fraternity, an illuminated testimonial was presented to him by the association at a dinner given in his honor March 16 at the Builders' Exchange, New York City. The dinner was attended by seventy-five leaders in the industry.

Among the speakers who told of his



TESTIMONIAL TO JAMES R. STRONG

long record of unselfish service were Samuel Hilton of Syracuse and John Hatzel, president of Hatzel & Buehler, Inc., New York, both being charter members of the organization; E. McCleary, second president of the A. E. I. and present executive committeeman; Charles L. Eidlitz, first president and now head of the New York Electrical Board of Trade, and William L. Goodwin of the Society for Electrical Endeavor. The testimonial was presented by Mr. Eidlitz. Joseph A. Fowler, newly elected president of the A. E. I., presided as toastmaster.

Association of Electragists Elects Fowler President

Meeting in New York on March 16 and 17, the executive committee of the Association of Electragists International elected Joseph A. Fowler of the Fowler Electric Company, Memphis, Tenn., as president in succession to James R. Strong of New York. W. A. Jackson of the W. A. Jackson Company, Chicago, was elected executive committeeman at large, and as an advisory board to the president these members were appointed: L. K. Comstock, New York, chairman; A. J. Hixon, Boston; G. M. Sanborn, Indianapolis; R. S. Stearnes, New Orleans; James R. Strong, New York; J. A. Kelly, Cleveland, and J. E. Aberbach, Detroit. L. K. Comstock will be national councilor in the United States Chamber of Commerce. Mr. Strong by unanimous resolution was asked to continue to serve as the association's representative on the executive committee of the National Electric Light Association.

Resolutions were adopted to the effect that the trade policy committee and the president be instructed to carry out vigorously the policy of the association—that is, that distribution shall be from manufacturer through jobber through contractor and dealer to consumer; that until further action the activities of the association toward an all-metal code be directed to the furthering of all-metal standards in congested districts and in certain classes of buildings to be further determined, and that the association's representative on the electrical committee be requested to work for a code requirement that lighting outlets for both ceiling and brackets be on circuits independent of other outlets.

The next meeting of the executive committee will be held in Chicago on June 22 and 23.

High-Voltage Laboratory for Stanford

California University Orders 2,000,000-Volt Testing Apparatus from General Electric Company

EQUIPMENT for the experimental production of 2,000,000 volts has been ordered from the General Electric Company by Stanford University, at Palo Alto, Cal., for use in a new testing laboratory soon to be established there. This will be the highest voltage ever produced at commercial frequency, and the apparatus will be powerful enough to cause a spark 17 ft. in length. The laboratory will be in charge of Prof. Harris J. Ryan, past-president of the American Institute of Electrical Engineers, who is an authority on high-tension phenomena.

The university has announced that Professor Ryan will be released henceforth from all classroom work so that he can devote his entire time to research in this field. A large plot of ground has been set aside for the laboratory and for an experimental transmission line of considerable length.

Speaking to a representative of the ELECTRICAL WORLD this week, Professor Ryan said: "The new high-voltage laboratory at Stanford University will owe its existence to the generous cooperation of men in the electrical power and manufacturing industries and to the authorities of the university, who hold to the vision of an economic interconnection of all power sources and markets in the Far West. They are making this laboratory possible to enhance the facilities required for the solution of the outstanding problems and to train men for the work."

Electric Lines Not Hit Hard by Middle West Tornado

A special dispatch received as the ELECTRICAL WORLD closes its forms says that incomplete reports from southern Illinois indicate that the transmission lines of power companies suffered no widespread damage from the tornado that passed over a small part of Illinois, Indiana and Missouri on Wednesday, March 18. The evidence is that transmission lines resisted the storm better than the frame buildings of light construction in the mining communities where the storm caused the greatest loss of life and property.

West Frankfort, Ill., from which the heaviest loss is reported, is on the lines of the Central Illinois Public Service Company. Murphysboro, De Soto and Parrish, Ill., and Griffin and Princeton, Ind., are other places that have suffered heavily. The territory is largely the same as or contiguous to that where the sleet storm of December brought so much damage to transmission systems.

Farrar Tells New Englanders of Good Outlook

Frederick A. Farrar, vice-president Electric Bond & Share Company, New York, addressed the Metropolitan Electrical League of Boston on March 13 upon the outlook for the electrical industry, pointing out that the customer-ownership movement is one of the greatest benefits to the public and to utility companies ever developed and picturing increased opportunities for service through railroad electrification and the extension of central-station business in varied fields. "This should be called a constructive age rather than a commercial age," said the speaker. "The telephone industry is as essential as the knife and fork on one's table. One hundred per cent answer to the radical will ultimately be found in customer ownership, and the response of the great insurance companies to opportunities to purchase utility bonds is now larger than ever before. The electrical industry is now on the eve of opening the gates of the savings bank as an investor in its securities. It is estimated that customer ownership will absorb five hundred millions in new securities this year. Gross earnings in the power and lighting field increase about 8 per cent per year, and about $5 investment is now required for each dollar of revenue."

Dinner to Edward D. Adams

The friends of Edward Dean Adams of New York, former president of the Niagara Falls Power Company, in the success of which he played a great part, will on the occasion of his seventy-ninth birthday, Thursday, April 9, tender him a testimonial dinner at the Hotel Waldorf-Astoria. Among these friends of the veteran engineer and industrial financier are men prominent not only in his own chosen fields, but also in art, literature, science, transportation and club life. The dinner committee of seventy-eight is made up of conspicuous representatives of all these interests. Charles F. Rand, Edward E. Bartlett, and John L. Merrill are joint chairmen of the committee and Alfred D. Flinn treasurer. At the dinner the speakers will be Dr. W. F. Durand, president of the American Society of Mechanical Engineers; James M. Beck, Solicitor-General of the United States; A. Monro Grier, president Canadian Niagara Power Company, and Mr. Adams.

Industrial Lighting Campaign Coming

Pledges of $90,000 Toward Hundred-Thousand-Dollar Fund Reported at New York Meeting of N. E. L. A. Commercial Committees —Progress Along All Lines

AT MEETINGS of the Commercial National Section committees of the National Electric Light Association, held from Monday to Thursday of this week at New York headquarters, total pledges of $90,000 were reported as already obtained to finance the budget of $100,000 that has been set up to carry out the national campaign under the chairmanship of Joseph E. Becker for the promotion of more efficient industrial lighting. This sum has been subscribed by manufacturers of lamps and reflectors and will be expended in the ratio of about 40 per cent for national and local publicity and the remainder to provide the material and service necessary to conduct a country-wide campaign in the coming fall through the co-operation of the central-station companies. The plans embrace industrial lighting demonstrations, lectures, advertising to industries and prizes to communities that make the best record in the improvement of factory illumination.

The meetings just held were the final meetings of the Commercial Section committees prior to the San Francisco convention in June. The committees devoted their attention to assembling and correlating the work of their various members, and it was apparent that under the chairmanship of W. R. Putnam the Commercial National Section has received a new impetus this year which will be reflected in the practical value of all committee reports.

Throughout the general as well as the separate committee meetings there was much evidence of the growing importance of the central-station commercial men's work in improving public relations through their constant contact with customers in promoting the sale of service. This element was particularly well emphasized on Wednesday night at an open meeting of the customers' relations committee, of which F. F. Kellogg is chairman. W. R. Putnam, section chairman, pointed out that the commercial men have a great responsibility in molding customer relations and, given good customer relations, a company's public relations problem is virtually solved.

A. W. Robinson, vice-president and general counsel of the Philadelphia Company, related some interesting personal experiences in building better public and commercial relations for the utilities in the Pittsburgh district. He declared that a company's public relations reflect the character of that company, and when things are not going right he urged the utilities to look first to themselves for the causes of trouble.

At the invitation of the Commercial National Section M. S. Sloan, president of the Brooklyn Edison Company and chairman of the executive committee of the Public Relations National Section, addressed the meeting on the commercial man's relation to public relations. Commercial departments exist, Mr. Sloan said, to sell electric service, and upon the manner and quantity of their sales efforts good public relations depend. It is highly important that customers be served willingly and courteously and receive a square deal, but it is of much greater importance that companies let their customers know that they have received a square deal, because the public is prone to take too much for granted.

M. H. Aylesworth, managing director of the N. E. L. A., bespoke the co-operation of the Commercial Section in furthering a better nation-wide understanding of the electrical industry and in combating insidious propaganda favoring government and state ownership of public utilities.

The electric cooking and heating committee (A. C. McMicken chairman) is preparing a report showing the progress of its investigation of the electric range load in the Northwest and purposes to carry on a similar survey on electric water heaters next year. This committee's report will also include data on range servicing and the cost of wiring.

Under the chairmanship of G. E. Miller the electric domestic refrigeration committee will complete an exhaustive study of this load and include a great amount of valuable information compiled from installations on customers' premises.

The power committee (V. M. F. Tallman chairman) has continued its study of industrial electric heating, and this year's report will contain consumption and load data on every type. Much of this committee's work has been issued in the form of interim reports, and in addition the committee has conducted its industrial heating schools, another of which will be held in co-operation with an electric manufacturing firm some time this spring. A commercial electric cooking manual is under preparation by a special sub-committee of which A. M. Lloyd is chairman.

The transportation committee (B. J. Martin chairman) is working with trade associations to show the advantage of electric trucks in their business and is preparing its report to show actual operating data on typical truck fleets.

The report of the lighting committee (C. C. Munroe chairman) will embody a vast amount of survey data valuable to central-station companies in developing residential, commercial, industrial and street highway lighting.

Louisville Extension Plan

Standard Gas & Electric to Install New Turbine There—Oregon and Colorado Program

AMONG more important undertakings scheduled for completion in 1925 by subsidiary properties of the Standard Gas & Electric Company, the holding organization for H. M. Byllesby & Company, is the installation of a 27,000-kw. turbo-generator in the Waterside plant of the Louisville Gas & Electric Company, which will bring the capacity of that station to 94,500 kw. Transmission-line extensions planned include one on the system of the Mountain States Power Company between Albany and Springfield, Ore., via Corvallis, and one on the same system between Independence and Salem, Ore. The Southern Colorado Power Company will build a 60,000-volt line between Pueblo and Canon City.

Southern Colorado Power Explains Extensions

W. N. Clark, general manager of the Southern Colorado Power Company announces that the erection of a 66,000-volt transmission line between Canon City and Pueblo, the headquarters of the system, will involve new substations at both of these cities. Included in the plans are also a new substation at La Junta, on the eastern end of the system, and a new high-voltage line from Rocky Ford which will give a duplicate transmission system from Canon City to La Junta. These various improvements will cost $640,000.

The company announces also the issue to it of a preliminary permit by the Federal Power Commission for a hydro-electric power development on Grape Creek, in Fremont and Custer Counties. Two reservoirs will be constructed. A dam to be built 6 miles below Westcliffe will impound 97,000 acre-feet. This dam will permit the generation of 7,500 hp. and a second dam will afford a generating capacity of 6,000 hp.

Much Activity on Northern States Power System

Considerably more than $7,000,000 is to be spent this year in Minnesota, Wisconsin, North Dakota and South Dakota by the Northern States Power Company in building projects and in extending and improving service. These undertakings, Vice-president Robert F. Pack explains, are part of the eighty-million-dollar construction program which was announced two years ago.

The work outlined includes a liberal appropriation for Minneapolis, where a new substation, to be known as the University substation, will take the place of the station now at Oak and Mary Streets. The Aldrich Avenue North substation will be improved and an underground cable laid from it to the Garfield and Thirty-third Street station and from the latter to the Pleasant Avenue Station at Richfield. The 73-mile, 110,000-volt line encircling the Twin Cities will be improved, and a seven-story addition to the office building of the company in Minneapolis will be erected. New lines to be built in Minnesota include one for 60,000 volts from Cannon Falls to Red Wing and one from the Wilson substation in Bloomington Township to Eden Prairie, and a number of lines, including that from Faribault to Mankato, will be rebuilt. A large turbine will be added to the steam plant at La Crosse, Wis., and the dam at St. Cloud, Minn., will be improved. Other work will be done in Chaska, Minn., Sioux Falls, S. D., and elsewhere.

Valuable Prizes for Reviews and Forecasts

Bonbright & Company Offer $10,000 in Awards for Best Summaries of Progress of Electrical Industry—American Superpower Adds Deferred Prize of $10,000

PRIZES aggregating $10,000 have been offered by Bonbright & Company, Inc., for the best contemporary review and forecast of the electric light and power industry, to be written in the form of an article summarizing the progress of the decade 1920-1930 and dated as of January 1, 1930. It will thus be in effect a five years' review and a five years' forecast. The articles are to comprehend the development of the industry in all its phases. They are not only to treat of engineering accomplishments, but to include also matters affecting public relations, finance, markets, transmission and distribution of electricity, its utilization and its effect on the industrial and social structure of the nation. The directors of the American Superpower Corporation will act as judges and in addition have authorized another prize of $10,000 in the name of the corporation to be awarded to that contestant whose paper, reviewed again in 1930, shall appear to have most nearly approximated the facts as they eventuate. This prize will be awarded as soon after January 1, 1930, as is possible.

The Bonbright award will consist of a first prize of $5,000, a second prize of $1,000, a third prize of $500, ten prizes of $250 each and ten prizes of $100. The articles must be submitted to Bonbright & Company on or before May 18 and are subject to the following regulations: They must be in the English language, typewritten and submitted on plain white paper. Although no arbitrary rule as to length has been set, it is suggested that they be confined within the limits of five thousand to ten thousand words. Every article is to be signed with a fictitious name and accompanied by a sealed envelope containing both the pseudonym and the contestant's real name and address. The article submitted may be a collaboration, the fictitious name selected representing two or more authors. Should a prize-winning article be the result of collaboration, the prize will be divided equally among the authors. No single competitor, either alone or in collaboration, may submit more than one article. The article may be accompanied by supplementary material in the shape of charts, diagrams, etc., but such additional material is in no sense obligatory.

If possible, the prize winners will be announced at the National Electric Light Association convention in San Francisco during the third week of June. All manuscripts will be preserved and again submitted for judgment on January 1, 1930, and the announcement of the winner of the additional prize of $10,000 will be made as soon thereafter as possible.

It will be seen that these valuable prizes afford an opportunity for the same competitor to win $15,000—$5,000 as a first prize in June and a deferred prize of $10,000 in 1930, should the first Bonbright prize winner prove also to have made the most accurate five-year forecast.

Terrora Plant of Georgia Company in Commission

The first unit of the new Terrora plant at the head of Lake Tallulah was put into commission on March 10, adding 15,000 hp. to the hydro-electric system of the Georgia Railway & Power Company. The starting up of the Terrora project marks the fifth step in the development of the Georgia Railway & Power Company and follows in succession the completion of the Tugalo development in 1924, which was preceded by the Tallulah Falls plant (started in 1912), the Mathis dam at Lake Rabun and the Burton dam at the head of the system.

The Terrora development consists of a tunnel a mile long, conducting the waters of Lake Rabun to the new plant. This tunnel is 14 ft. high and 13 ft. in diameter. Penstocks 9 ft. in diameter and approximately 875 ft. in length conduct the water to the turbines in the power house. The tunnel cuts off about 6 miles of the Tallulah River and gives the plant a gross head of 194½ ft. The power house is set in solid rock at the head of Lake Tallulah, the substructure being of reinforced concrete and the superstructure of brick and steel. A second 15,000-hp. unit is being rushed to completion.

In addition to the Terrora project, the Georgia Railway & Power Company's building program for the future includes the Yonah dam and power plant and the Nacoochee development, both under construction. The Yonah dam will be 75 ft. in height and about 800 ft. long, with a power house equipped with waterwheels of 37,500 hp. and generators rated at 25,000 kw. The Nacoochee development, just below Burton on the Tallulah River, will consist of a dam 60 ft. high and a power house with a waterwheel of 7,500 hp. and a generating capacity of 5,000 kw. The last step of the company's building plan, not yet started, will be a 9,000-hp. plant at Burton dam.

Revocable Permit Wins

Oklahoma Senate Passes Measure—Utility Bills in Indiana, Colorado and Oregon

OKLAHOMA has adopted the bill to institute the revocable permit for utility companies as a substitute for fixed-term municipal franchises. This measure, which had already passed the Lower House of the State Legislature, was favorably reported by the Senate committee, and on March 13 the Senate indorsed it by a vote of twenty-six to fifteen. The Governor has announced that he will approve it. This measure was the most widely opposed bill before the present Legislature, but admission by the secretary of the Municipal League of Oklahoma that his statewide appeal for opposition on the part of city officials was made without reading the bill and contained inaccuracies and mistakes seriously impaired the force of the protest prompted by his efforts. Declaration by utility executives that Oklahoma's disadvantage in obtaining money for utility expansion has cost the state a million dollars in bond discounts in the last five years, which consumers have had to pay, and proof that all rights now possessed by cities with relation to public utilities are preserved except the right to vote on franchise renewals, proved potent arguments with the majority of the Senators.

UTILITY BILLS IN OTHER STATES

The Indiana State Senate has passed the Quillin public utility bill, placing under the control of the Public Service Commission open-end mortgages and trust deeds executed between one corporation and another. The bill amends the present state utility law by adding to the clause reading "without the consent of the Public Service Commission no public utility shall sell, assign, transfer, lease, etc.," a phrase "or incumber its franchise." It places under the jurisdiction of the commission any special contracts for service with another utility and also provides that written consent must be secured of three-fourths of the voting stockholders before a utility can buy, sell or merge with other utility properties.

The Electrical Co-operative League of Denver has sponsored a bill providing for standardized lighting in places of employment, education and amusement. This measure was introduced soon after the opening of the General Assembly in Colorado and has been reported out by the judiciary committee. The bill empowers the State Labor Commissioner and his inspectors to establish adequate standards of lighting as measures of safety.

As emergency legislation to help meet the state budget in the coming biennial period, the Oregon Legislature has passed an act providing for payment by each public utility and railroad of a tax based on annual gross revenue. The act is temporary in character and automatically expires at the end of the current biennial period. The tax is in the form of an annual fee, not a percentage, graduated upward as the gross earnings of the individual company fall within certain definite limits. Twelve different fees ranging from $10 in the case of the company having annual earnings of less than $5,000 to $3,000 in the case of the company having earnings in excess of $6,000,000 are prescribed.

Debate Abolition of Commission in Tennessee Legislature

The bill to repeal the public utilities act of 1919, thereby abolishing the Railroad and Public Utilities Commission, has made little progress in the Tennessee Legislature. Last week the public utilities committee of the Senate voted five to one for its rejection, and the House judiciary committee, which had just participated in a joint hearing with the Senate utilities committee, adjourned without acting on the bill, but after refusing by a vote of nine to four to accept an amendment to the bill which would also repeal the 1921 utility legislation amending the 1919 act.

At the joint hearing, which was largely attended by interested citizens, the commission was attacked and defended by men from various cities and districts. Horace Stout, counsel for the commission, pointed to many decreases in rates made on its initiative and compared utility charges with other costs.

Governor Peay sent a message to the General Assembly urging the repeal of the act. He based his plea on the fact that the Democratic party, which controls the state government, had made repeal a plank in its platform. Faith with the people, the Governor said, should be kept, although "perhaps the people will be disappointed in the relief which they are expecting from the repeal of this act."

Hoover Asked to Start Power Survey for South

Representatives from seven state utilities commissions in the Southeastern States, meeting in Atlanta recently, adopted a resolution inviting Secretary Hoover of the United States Department of Commerce to initiate a superpower survey for the States of Virginia, Kentucky, Tennessee, North and South Carolina, Florida, Georgia, Alabama, Mississippi and Louisiana. This survey, which was asked in a resolution prepared by McGregor Smith, engineer of the Tennessee Railroad and Public Utilities Commission, would include a study of hydro-electricity and steam-generated electricity with a thorough research into economic problems, such as transmission costs and similar questions.

Four More Drafts of A. I. E. E. Standards Ready

Four more sections of the American Institute of Electrical Engineers' Standards have been brought by the working committees to a point where the comments of the general Institute membership are desired prior to their presentation for adoption. These sections are: No. 5, "Direct-Current Generators and Motors"; No. 7, "Alternators, Synchronous Motors and Synchronous Machines in General"; No. 16, "Railway and Mine Locomotive Control Apparatus," and No. 39, "Resistance Welding Apparatus."

These drafts of standards have been prepared by working committees in whose appointment every effort has been made to select the men from all branches of the art most competent to contribute directly to the development of an accurate and generally acceptable set of standards. Before their adoption as Institute standards, however, the procedure is being followed of submitting each section to the membership for comment and criticism. Copies of each of the four reports noted above are now available, without charge, from Institute headquarters. Comments should be received within a period of one or two months.

Ontario Hydro Extension

Program Now Under Way Involves an Expenditure of Approximately $20,000,000

BUDGET figures for the Ontario Hydro-Electric Power Commission indicate an expenditure of eighteen or twenty million dollars in the near future. Official estimates of the province for the fiscal year ending October 31, 1925, include these figures: Niagara System, $13,500,000; Georgian Bay System, $1,130,000; St. Lawrence System, $1,720,000; Rideau System, $100,000; Thunder Bay System, $2,550,000; Central Ontario System, $1,400,000; Nipissing System, $180,000; Ottawa System, $780,000; miscellaneous betterments, $550,000. This makes a total of $21,910,000, of which part has, of course, already been expended.

Of the expenditure on the Niagara System more than half will be on the Queenston-Chippawa development. Here the eighth and ninth 55,000-hp. turbogenerators will be installed this year, and the final designed capacity of ten units, totaling 550,000 hp., will be achieved in 1926. Niagara System expenditure includes also high-voltage transformer stations at Guelph, Preston, Stratford, Woodstock, Kent and Essex, costing in all $1,000,000, and $2,000,000 for high-voltage lines. Half a million will be spent in rural transmission. The South Falls station on the south branch of the Muskoka River, which is included in the Georgian Bay System, is being remodeled. Two units of 2,200 hp. each are being installed this year, one of these replacing an old unit of 700 hp. On the same river at Hanna Chute, a short distance above South Falls, the commission will construct a new 1,800-hp. development.

The St. Lawrence System expenditure includes $1,500,000 for developments at Morrisburg, and the Thunder Bay System expenditure includes $1,700,000 to cover the completion of units Nos. 3 and 4 and part of the cost of units Nos. 5 and 6 at Cameron's Falls and the completion of the dam at Virgin Falls. The capacity of the stations at Port Arthur and Fort William is being increased, and $500,000 was appropriated for high-tension lines. The Nipigon station at the head of the lakes was increased last year by the addition of two 12,500-hp. units,

bringing the total to 50,000 hp. Two further units of similar capacity which are being added this year will complete the designed capacity of this station.

In the Central Ontario System a 6,600-hp. development at Dam No. 8 on the Trent River was completed and brought into operation last year, while a 4,800-hp. development at Dam No. 9 on the same river will be completed early this year. These stations are of special interest inasmuch as they are both being operated by remote supervisory control from the Ranney Falls station a few miles distant.

Briefer News

Iowa Section, N. E. L. A., Announces Date of Meeting.—A joint convention of the Iowa Section of the National Electric Light Association and the Iowa Electric Railway Association will be held at Waterloo, Iowa, on June 3 and 4, according to announcement just made by the respective presidents of the two associations.

First Dinner-Dance Held by Chicago A. I. E. E. — A departure in branch activities of the A. I. E. E. was established on March 7 when the Chicago Section of the Institute held a dinner-dance at the Edgewater Beach Hotel to promote acquaintance and social relations. It was highly successful in all respects, about 150 attending.

Industrial Electric Heating Meetings in Pennsylvania.—The electric cooking and heating committee, Commercial Section, Pennsylvania Electric Association, has arranged to hold two meetings devoted entirely to the discussion of industrial electric heating. One will be held at Pittsburgh, March 27 and 28, and the other at Philadelphia, April 3 and 4. The manufacturers of industrial heating equipment are cooperating by furnishing capable speakers to outline the fundamentals of industrial heating and its principal applications.

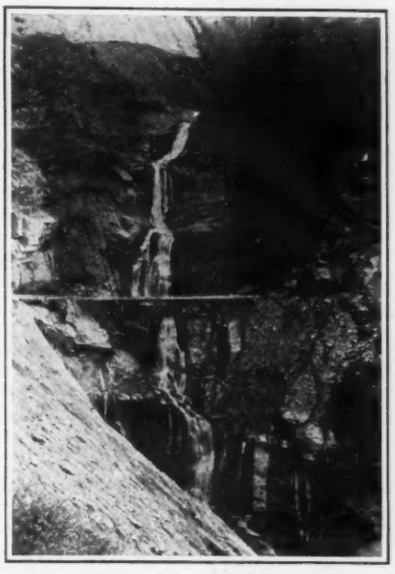
Milwaukee and Racine Linked by 132,000-Volt Line. — Completion has been announced by the Milwaukee Electric Railway & Light Company of a half-million-dollar outdoor substation at Racine, Wis., connecting the Milwaukee and Racine properties with a 132,000-volt steel-tower transmission line. Placing this station in operation gives Racine a direct source for all the electrical energy it will require for years to come. The steam generating plant which has been supplying Racine heretofore will be maintained as a standby plant.

Hydro-Electric Project for Black River, Mo.—Articles of incorporation for the Black River Power & Development Company have been filed at Poplar Bluff, Mo. The company is temporarily capitalized at $75,000. It has applied to the Federal Power Commission for a preliminary permit to construct a large dam on the Black River above Leeper, Mo. This dam will perform the twofold duty of permitting the generation of power and protecting farmlands from floodwaters. It is estimated that the project will cost upwards of $3,500,000.

Experimental Tests of Arch Dam Are Assured

AS THE result of subscriptions totaling $61,700, construction work is to start on the experimental arch dam sponsored by the arch dam committee of the Engineering Foundation as soon as details of construction can be worked out. Funds will be sufficient for the first series of tests. The last subscription of $15,000 was from the supervisors of Los Angeles County, acting for the county flood control district. In addition to cash subscriptions from eighteen contributors, the California Cement Company has donated sufficient cement for the construction of the dam.

The site tentatively chosen is on Stevenson Creek, a tributary to the San Joaquin River in central California. It is ideal for the purpose because of the nearly vertical rock walls of the creek canyon which will keep down the impounded water to only a few acre-feet, and further because of the ability to control easily the flow of the creek from Shaver Lake. The purpose



PROSPECTIVE SITE OF TEST ARCH DAM ON STEVENSON CREEK

of the test dam is to secure much needed data on the design of such structures. Although arch dams have been used for centuries, their design is still largely a matter of theory, and it is not known what factor of safety actually exists. With the data that will be made available from tests on this experimental arch dam, together with the results of research by the Engineering Foundation on deflection and other deformation of existing dams, it should be possible to design structures and build them at a minimum of cost consistent with an ample factor of safety. It may thus be possible to construct dams for power and irrigation projects that are not now economically feasible.

Spring Valley (Ill.) Utilities Company Sold.—The Illinois Power & Light Corporation has acquired, subject to the approval of the Illinois Commerce Commission, the Spring Valley Utilities Company, owned by Brown Brothers and representing a utilities investment of $1,500,000. The Spring Valley company serves a wide territory with purchased energy, which, it is said, will in the future be supplied from the Keokuk Dam.

Barstow Extension in Florida.—The Florida Public Service Company, a subsidiary of the General Gas & Electric Corporation, has acquired the electric and water systems of the Apopka (Fla.) Water & Light Company and the electrical distribution system in the town of Ocoee, Fla. The Florida Public Service Company, which furnishes electric light and power to thirty communities in the central part of the state, has just completed a high-tension line connecting its Orlando and Eustis generating stations. Another line from Ocoee to Apopka will be started soon.

St. John, N. B., Not Under Jurisdiction of Commission.—The right of the city of St. John, New Brunswick, to engage in the sale of electrical appliances in competition with the New Brunswick Power Company, Ltd., has been upheld by the courts. The right to sell and distribute electric light, heat and power in adjoining suburbs has, however, been refused to the city until authority for such sale has been granted under the New Brunswick electric power act. The court ruled that the city did not come under the control of the Public Utilities Board—a decision regarded as of far-reaching importance in those parts of the province where municipally owned hydro-electric enterprises are being conducted.

Expansion in North Dakota.—The Midwest Power Company of Devil's Lake, N. D., which, as announced last week, will probably be merged with the Otter Tail Power Company of Fergus Falls, Minn., has recently completed the construction long under way of an 87-mile, 45,000-volt transmission line from its central plant to Carrington, N. D. On the Otter Tail transmission system construction is contemplated which will add more than a hundred miles of line to the company's North Dakota network. One line will begin at Enderlin and run to the company's plant at Jamestown, another will run from Buffalo to Casselton, and a third from La Moure to Edgeley.

Municipal Plant Problems in Hamilton, Ohio. — The people of Hamilton, Ohio, who recently determined to retain their municipal light plant, face the possibility of paying directly for lighting the city's streets. Since the erection of the plant twenty years ago the city has paid for street lighting out of receipts from service to private consumers. This being no longer feasible, two plans now are under consideration. One is to charge the cost of street lighting on the general tax duplicate and the other is to assess

property along the streets according to foot frontage. The Council also has under consideration the passage of an ordinance fixing at $6 a month the minimum charge where there is a two-way switch and consumers have the option of using either the city energy or the Hamilton Service Company energy. The city is now charging only 50 cents a month for this service, while the Hamilton Service Company is charging $6.

Direct Cable to Italy Opened.—Opening of the first direct cable connection between the United States and Italy, which was made possible by the completion of the Italian line from Rome to the Azores, took place on Monday, March 16, when formal congratulations were exchanged between the heads of the two nations. The new line from New York to the Azores was built by the Western Union and that from Rome to the Azores by the Italian Submarine Cable Company. The total length is 5,000 miles. The use of "permalloy" permits the sending of messages at a speed five times as great as that of the earlier cables.

Legislative Committee Opposes Sale of Norwich (Conn.) Plant.—The Connecticut legislative committee on incorporations has rejected bills to authorize the city of Norwich to sell its municipal lighting plant and franchise for gas and electric distribution and will report unfavorably thereon to the General Assembly. A. E. Fitkin & Company of New York bid $3,000,000 for the franchise. Bodell & Company of Providence, the Eastern Connecticut Power Company, the Thames Power Company, the Norwich Gas & Electric Company and the Rockville-Willimantic Lighting Company asked for territorial rights.

Irish Free State Parliament Favors Development of Shannon. — Although there is said to be opposition on the part of engineers and experts to the scheme drawn up by the Siemens-Schuckert company for a hydro-electric plant on the River Shannon in Ireland, the Free State Parliament is apparently strongly for it, and it seems likely to be carried through. The German company's plan is for partial development only. A fuller scheme apparently would be undertaken later on, and in twenty years or so, if all went well, the Shannon would be linked up with the Liffey and possibly other Irish rivers in a general scheme for production of a great amount of electrical energy. The cost of the partial scheme will be £5,200,000. A power house will be built near Arnac Rusha, 3 miles from Limerick, where three machine sets will be installed, capable of developing 30,000 hp. Embankments as high as 40 ft. in some places will be built along the Shannon for about 75 miles, and the area subject to chronic flooding near Lough Derg will be drained. The Shannon will be deepened from Limerick to Killaloe and a new canal 6½ miles long built. The full development of the Shannon, which the German firm hopes to undertake at a later date, will, it is estimated, produce at least 275,000,000 kw.-hr. per annum.

Tennessee Electric Power Company to Spend $6,000,000 for 1925 Construction.—Six million dollars for extensions and improvements is included in the budget of the Tennessee Electric Power Company for 1925. Of this $800,000 will be spent at Chattanooga and as much more at Nashville. No new power projects are scheduled, though the rating of the Hales Bar steam station will be raised to its full figure of 40,000 kw. The work of raising the Great Falls dam will be finished in May. On these two developments $825,000 will be spent, and the reconstruction and erection of transmission lines will cost $870,000. New erection includes a 44,000-volt line from Hales Bar to Richard City and the beginning of work on a 120,000-volt, 40-mile line from Cleveland to Chattanooga.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

American Institute of Electrical Engineers—St. Louis, April 13-17; Swampscott, Mass. (regional), May 7-9; Saratoga, N. Y., June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Southwestern Division, N. E. L. A.—Eastman Hotel, Hot Springs, Ark., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southeastern Water and Light Association—Hotel Patten, Chattanooga, Tenn., April 21-23. W. F. Steiglitz, Columbia, S. C.

Arkansas Utilities Association—Hot Springs, Ark., April 21-24. R. I. Brown, Arkansas Central Power Co., Hot Springs, Ark.

American Welding Society—New York, April 21-26. Miss M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Niagara Falls, N. Y., April 23-25. C. G. Fink, Columbia University, New York.

Southwestern Public Service Association—Rice Hotel, Houston, Tex., May 5-8. E. N. Willis, 403 Slaughter Bldg., Dallas.

Missouri Association of Public Utilities—Joplin, Mo., May 7-9. F. D. Beardslee, 315 North 12th St., St. Louis.

American Society of Mechanical Engineers—Milwaukee, May 18-21. C. E. Davies, 29 West 39th St., New York.

Electrical Manufacturers' Club—Hot Springs, Va., May 19-22. S. B. Belden, Jeffrey Manufacturing Co., Columbus, Ohio.

Middle West Division, N. E. L. A.—Hotel Fontenelle, Omaha, Neb., May 20-22. (Conjointly with Nebraska Section.) H. M. Davis, Fraternity Building, Lincoln, Neb.

Georgia Electrical Association—Atlanta, May 21-22. W. W. Barr, Georgia Railway & Power Co., Atlanta.

Electric Power Club—Hot Springs, Va., May 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

Electrical Supply Jobbers' Association—Hot Springs, Va., June 2-5. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Association of Engineers—Orlando, Fla., June 2-5. C. E. Drayer, 63 East Adams Street, Chicago.

Iowa Section, N. E. L. A.—Waterloo, Iowa, June 3-4. H. E. Weeks, 623 Union-Davenport Bldg., Davenport.

National Electrical Credit Association—Atlantic City, June 6-7; Philadelphia, June 8-9. F. P. Vose, Marquette Bldg., Chicago, Ill.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 8-12. F. Nicholas, 30 East 42d St., New York.

Pacific Coast Electrical Association (Geographical Division N. E. L. A.)—San Francisco, June 15. S. H. Taylor, 529 Rialto Bldg., San Francisco.

National Electric Light Association—San Francisco, June 15-19. M. H. Aylesworth, 29 West 39th St., New York.

Society for the Promotion of Engineering Education — Union College, Schenectady, N. Y., June 17-20. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Public Service Company's Franchise in Denver.—A grand jury at Denver has been asked to conduct an investigation of the Public Service Company of Colorado as the result of reports that a uniform schedule of rates is not maintained by it, and a number of large power consumers have been subpœnaed to appear before the jury and present their bills. The City Council as yet has not taken definite action on the company's request that the question of renewing its franchise be submitted at the city election in May, and the proceedings before the grand jury are generally held to be an attempt to prejudice the issue. The Chamber of Commerce, co-operating with the city, has appointed a committee of eighteen to investigate the draft of the new franchise. The members of this committee are prominent lawyers and business men.

Co-operation Between City and Company in Wynooche Development Proposed.—Proposing joint development of the Wynooche River by the city of Aberdeen, Wash., and the Grays Harbor Railway & Light Company, the company has suggested to the City Council that the proposed bond election on March 24 be called off and that the city co-operate with the utility, the city to have the water supply and the company the power development. The company declares that the joint development would guarantee the city an adequate water supply at a cost much less than the proposed $700,000. H. W. Crozier of San Francisco, engineer for the Federal Light & Traction Company, who has spent the past year investigating the Olympic peninsula power field, says that if the city persists in its Wynooche power project, Eastern capital will not invest in the Olympic peninsula development.

New Power Plants on the St. Croix River.—Surveys have been completed and plans are under way for the two new water-power plants that the Wisconsin-Minnesota Light & Power Company—now a subsidiary of the Northern States Power Company—is to build on the St. Croix River, which forms part of the boundary between the two states. One of these plants will be built at Kettle River Rapids, about 40 miles above St. Croix Falls. The head here will be about 80 ft. and the installed capacity about 40,000 hp. This construction will involve an expenditure of more than $5,000,000. The second plant, which will be nearer St. Croix Falls, will have an ultimate developed head of about 105 ft. and will involve an expenditure of approximately $3,000,000. The main undeveloped powers of the Wisconsin-Minnesota Light & Power Company are three on the Red Cedar River and seven on the Chippewa River in the vicinity of Chippewa Falls, Wis. Among the early sites to be developed is that at Menomonie on the Red Cedar River.

Men of the Industry

C. H. Sanderson Assistant Electrical Engineer of New York Edison

Clarence Herbert Sanderson of the engineering staff of the New York Edison Company has been appointed assistant electrical engineer of that company, succeeding R. H. Tapscott, who, as already announced in the ELECTRICAL WORLD, has assumed the duties of electrical engineer. Mr. Sanderson entered the employ of the New York Edison Company in 1920. He received the position of assistant to the chief electrical engineer, and his work covered specifications, design, purchasing and the supervision of

C. H. SANDERSON

operation, maintenance and repairs. He went to New York from the Havana Electric Railway, Light & Power Company, where as chief electrical engineer and later assistant chief engineer he installed a 50,000-kva. steam turbine plant and reorganized and modernized the majority of that company's technical departments.

For ten years prior to joining the Havana company Mr. Sanderson was in the engineering department of the Westinghouse Electric & Manufacturing Company, specializing in switchboard and power station design. He is a native of Illinois and a graduate of Ohio State University. For five years, while with the Westinghouse company, he was instructor in mathematics at the Carnegie Institute of Technology. He is a fellow of the American Institute of Electrical Engineers and has served on numerous technical committees of both that society and the National Electric Light Association.

W. A. Grove, for the past three years advertising representative for the Curtis Publishing Company, in charge of the *Saturday Evening Post* in the St. Louis District, has been appointed manager of advertising and sales promotion for the Edison Electric Appliance Company of Chicago, manufacturer of Hotpoint appliances. Mr. Grove, following graduation from the University of Michigan, engaged in engineering sales work, several years of which were spent in the electrical power field.

R. M. Edwards, formerly local manager of the Oklahoma Gas & Electric Company at Elk City, has been transferred to the general operating department of the company.

M. S. Sloan, president of the Brooklyn Edison Company, has been appointed a member of the advisory board of the Police Department of the City of New York, with the rank and title of Honorary Police Commissioner.

Norman Franks, manager of the Canadian General Electric Company, Ltd., at Edmonton, Alberta, has been appointed district manager of the Winnipeg office.

Samuel Insull has been elected chairman of the board of directors of the Indiana Service Corporation, Fort Wayne, Ind., to succeed Henry Sanderson. **Charles W. Chase** and **Samuel Insull, Jr.,** have also been elected to the directorate, succeeding Frank M. Tait of New York and Percy M. Chandler of Philadelphia.

John J. Gaffey, formerly with the Edison Electric Illuminating Company of Boston and later assistant engineering manager for the Harry M. Hope Engineering Company, has recently joined the engineering force of the station betterment division of Stone & Webster, Inc., Boston.

A. F. Senior has been elected assistant secretary and treasurer of the Public Service Company of Northern Illinois, having general charge of the purchasing department. Mr. Senior began his service with the Public Service Company in 1913 as a clerk in the engineering department.

F. I. Woltz has resigned as power sales engineer with the Central Hudson Gas & Electric Company of Poughkeepsie, N. Y., and on March 16 joined the forces of the General Engineering & Management Corporation of New York City. Mr. Woltz will have supervision of power engineering and sales for the numerous central-station companies in the Middle, Western and Southern States controlled and operated by the corporation. Prior to his connection with the Central Hudson Gas & Electric Company in 1917, he was power sales engineer for the Union Gas & Electric Company, Cincinnati. Mr. Woltz was graduated in 1909 from the Pennsylvania State College and since that time has been engaged in industrial and power engineering work.

T. P. Walker New Manager in El Paso

Tom P. Walker, newly appointed manager of the El Paso Electric Railway Company, succeeding Alba H. Warren, has been with the Stone & Webster organization for a number of years, being manager of the Baton

T. P. WALKER

Rouge (La.) properties until the time of his recent promotion. Following his graduation from the University of Nevada, he entered the employ of Stone & Webster at Reno, Nev. Later he became identified with the Boston office, and following service in the war he went to Haverhill, Mass., as superintendent, subsequently becoming manager of that property. He then was transferred to Baton Rouge and since April, 1923, has been manager of the combined gas and electric Stone & Webster utility in that city.

Obituary

Royal J. Ridgeway, superintendent of the Miniature Lamp Works, Buffalo, dropped dead of heart disease in his office February 23. Mr. Ridgeway had been superintendent of the company since 1919 and was fifty years of age.

Charles A. Hexamer, secretary of the Philadelphia Fire Underwriters' Association, died at his home in that city on March 9 of pneumonia. After holding several positions with insurance companies, Mr. Hexamer was made secretary of the local board of fire underwriters in 1894, and following a short association with the Hartford Fire Insurance Company was elected to the post he held at the time of his death. He served terms as president of the National Fire Protection Association and chairman of the board of consulting engineers of the National Board of Fire Underwriters. He was a member of the Engineers' Club of Philadelphia, the Franklin Institute and the National Fire Prevention Association. Mr. Hexamer was seventy-three years of age.

Vernon Wilder, superintendent of the Southern Sierras Power Company in the Bishop (Cal.) district and superintendent of the Interstate Telephone Company in the same section, died of heart disease February 20, while on a business trip to Riverside. From 1898 to 1912 he was chiefly connected with the Bell Telephone Company, and in 1914 he moved to Bishop, where he continued in the telephone field, later becoming connected with the Southern Sierras Power Company. Mr. Wilder was fifty years of age at the time of his death.

Commission Rulings

Approval of Bond Issues Constituting 77 per Cent of Outstanding Securities.—Authority to issue bonds to liquidate notes or accounts payable to a parent company, the indebtedness having been incurred to raise funds with which to make additions and to purchase an electric light plant, was granted by the Nebraska State Railway Commission in a case affecting the Omaha & Lincoln Railway & Light Company, although this would result in a financial structure in which the bonds would equal 77 per cent of the total stocks and bonds. The commission said: "Reputable financial institutions approve issues of bonds up to 85 per cent of construction cost. This commission has always deemed that too liberal an attitude. In its opinion the proposed financing would have been more proper had a portion of the funds been secured from stock sales. On the other hand, the relation between applicant and parent company is such that it is able to dispose of its 5 per cent first mortgage bonds at par at this time, when applicant could not dispose of the same bonds except at considerable discount if seeking its own market. It is excellent financial strategy to secure money at this time on a 5 per cent basis when similar corporations in this state without such financial connections have paid as high as 8 per cent on a good security."

Apportioning Profit from Leased Property Between Stockholders and Customers.—The Indiana Public Service Commission in prescribing a return on water property leased by the Indiana Power & Light Company said: "It would appear that in leasing property which petitioner desires to operate for the benefit of the entire community it assumes somewhat the position of a trustee but that the patrons of the company should not be bound by any unreasonable terms of said lease. It would appear that if, for instance, the commission were confronted with the problem of fixing rates which were to provide for the payment of an exorbitant lease rental, the equities in the case would demand that the commission find and determine the equivalent of a fair lease rental and fix the rates accordingly. Concurrently, it would seem that if the actual lease rental contracted to be paid was unusually low, the stockholders of such lessee company should not be deprived of all the benefits of such advantageous contract, and while it might not be advisable to place the value of said leased property on an equal parity, in a rate case, with the value of the property actually owned by said lessee, it would not seem to be inconsistent to permit both lessee and patron to share the benefits thereinunder. While the commission is of the opinion that the stockholders are not entitled to the full benefit of such a condition, they are entitled to at least a proportion of the same. Therefore it would seem that the fair and equitable method would be to distribute the benefits of an advantageous lease fairly between the stockholders of such lessee and the patrons thereof."

Recent Court Decisions

No Injustice Done to Public When Commission Bases Rates on an Indefinite but Minimum Valuation.—The Public Service Commission of Pennsylvania, on application by the Philadelphia Rapid Transit Company, gave the latter provisional permission to put into effect a proposed schedule of increased rates until an investigation could be completed and final decision rendered by the commission. The city of Philadelphia and others appealed from the order of the commission to the Superior Court, which dismissed the appeals and affirmed the order. In its finding the court said: "The questions to be decided by this court are: (1) Did the commission have the power to make the order appealed from? (2) If so, was the order reasonable and in conformity with law? . . . We have no doubt of the power of the commission to make a temporary order with regard to rates during the pendency of a fuller investigation. . . . To exercise such power it is not required that the utility company should be threatened with absolute bankruptcy if withheld. The commission need only be satisfied that injustice will be done if action is unduly deferred. In some instances such an order is of value in the pending investigation because it substitutes for mere estimates of income the concrete results obtained from actual operation, so that if the result exceeds the estimate to such an extent as to produce a larger revenue than is allowable on the basis of the property used and useful in the public service, the tariff should be reduced in the final order or decision so as to accord with the allowable revenue. . . . We come, then, to the second issue presented by this appeal, 'Was the order reasonable and in conformity with law?' and under the express terms of the statute the burden rests on the appellants of proving the contrary. It must be borne in mind that no question of the confiscation of the utility company's property by the order appealed from is raised by this appeal, and, therefore, it is not our province to exercise our own independent judgment upon the facts in evidence and substitute our judgment thereof for that of the commission. . . . While the commission did not determine with mathematical accuracy the present fair value of the property, it did determine that its minimum value was above $200,000,000, and the finding was supported by evidence permitting a check and audit of the items of which it was made up. The only party injured, if at all, by the failure to fix the exact valuation of the company's property was the company itself, and it made no complaint, because its tariff of rates had been sustained. Certainly the city and the public using the cars were not prejudiced by the failure of the commission to determine precisely how much more than $14,000,000 the company was entitled to receive as a fair annual return upon its property used and useful."

Rates Found Confiscatory by Supreme Court Because of Arbitrary Omissions in Valuation.—On the ground that the rate of return fixed was less than 5 per cent and hence "plainly inadequate," the United States Supreme Court in an opinion rendered by Justice Sutherland March 2 reversed the Ohio State courts in the suit of the Ohio Utilities Company against the Public Utilities Commission of that state, which involved rates to be charged for electricity in the village of Hillsboro. This village is one of a number of communities served with gas or electricity, or both, by the company. In 1920 the company submitted a schedule of rates for electricity for Hillsboro, which was protested. The commission held a hearing and a rehearing. In the meanwhile the company was allowed to charge its scheduled rates after filing a bond to refund to consumers any difference between the rate charged and that fixed by the commission on final determination. The commission fixed the rates below those in the company's schedule, and the company sued for an injunction, alleging that the commission's rates were confiscatory. The state courts held for the commission. The United States Supreme Court in its opinion declares that the commission arbitrarily eliminated certain items from its engineer's report of the fair value of the company's property allocated to Hillsboro and on this basis fixed a rate of return too low.

Court Cannot Judicially Know that High-Voltage Electricity Would Not "Jump" Distance of Two Feet.—The Court of Appeals of Georgia, in reviewing damage suits brought by Lawley and Jones against the Central of Georgia Railway Company and the Georgia-Alabama Power Company, in which certain allegations were made concerning the death of one workman and the injury of another from a flash of electricity from a high-voltage line, said: "Neither the trial judge nor this court can assume, as a matter of common and established knowledge, that electricity, especially an indirect or alternating current, . . . would not, under the high voltage stated, the peculiar arrangement of the wires and the other facts alleged, jump for the distance of two feet or less to the heads of the injured persons, or draw a steel tape measure to such wires in the manner charged. To assume the physical impossibility of such effects would require expert knowledge as to the laying of electric wires, the effects and dangers of various kinds of current and voltage, such as would fall within the domain of an electrical engineer or scientific expert and observer and such as this court does not possess or assume." (126 S. E. 273.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Transmission Tower Suit

Milliken-Aermotor Case Involving the Alleged Infringement of Patent Dismissed for Want of Equity

THE claim of Foster Milliken against the Aermotor Company for alleged infringement of Patent No. 923,557, instituted February, 1924, has been declared invalid and was dismissed for want of equity, and a decree to that effect was entered March 14, 1925, in the District Court of the United States, Northern District of Illinois, Eastern Division, where the case was heard before Judge James H. Wilkerson. The fifth claim on which the case was based was: "A structural steel pole having a pyramidal pedestal portion, a tower portion carried by the pedestal portion of approximately uniform cross-sectional area and cross-arms arranged at intervals of the tower portion of the pole of expanded width at the center and having diagonal braces reinforcing the tower."

In effect, the decree read: That patent 923,557 granted Foster Milliken June 1, 1909, for improved tower on pole is, in respect to the fifth claim thereof, invalid (that being the only claim under which infringement has been charged); that the claim was anticipated in all substantial respects by the prior manufacture, use and sale by the defendant of towers supplied by it to the sanitary District of Chicago and others, and also by the use by the Sanitary District of Chicago of the towers so manufactured substantially prior to the alleged invention by Milliken; that such changes as Milliken made in the prior art did not represent patentable invention but merely a change in form, proportion and degree, doing the same thing in the same way by substantially the same means.

Therefore it was decreed that the Milliken patent is invalid as to the fifth claim; that the injunction heretofore issued by the court be continued in force during the remainder of the term of the patent, enjoining the plaintiff, its attorneys, agents and representatives, from (1) publishing or circulating the advertisements mentioned in the case or representation similar thereto or similar to those contained in the letters of Munn, Anderson & Munn of November 21, 1923, and January 22, 1924, and letter of Riter-Conley Company of January 18, 1924; (2) from circulating by print, letter or orally representations that the Milliken patent has been adjudged valid or infringed; (3) from seeking to intimidate dealers in or purchasers of electric transmission towers or poles or prospective purchasers of such towers or poles; (4) from coercing them into settlement by threats of suit or otherwise.

Record Building Forecast for 1925

Prospective Construction Tabulated for Nineteen Types of Building and Six Geographical Divisions—Several Years of Great Activity Ahead

A FORECAST of the building activity for the year 1925 that is based on a comprehensive survey carried out through individual reports from a large number of architects and from building contractors, bankers and others directly interested in the construction field has been made by the *Architectural Forum* and is presented here in tabular form. Table I gives the money value of prospective new building construction in the United States for 1925 and covers nineteen types of buildings and six geographical divisions. Table II shows the comparative activity forecast in various building types during 1925 as contrasted with that in 1924.

All evidence seems to bear out the prediction that 1925 is to be another record building year and that the great momentum of the building industry will continue almost unchecked. Building costs have remained fairly stable during 1924, and with the exception of some seasonal fluctuation it is anticipated that costs will remain steady during 1925. S. W. Straus & Company in commenting on the building situation said that the year 1924 closed with a

TABLE I—MONEY VALUE OF PROSPECTIVE NEW BUILDING CONSTRUCTION IN THE UNITED STATES FOR 1925

Forecast based on survey recently conducted by the *Architectural Forum* covers nineteen types of buildings and six geographical divisions.

Building Types	Northeastern States	North Atlantic States	Southeastern States	Southwestern States	Middles State	Western States	U. S. A.
Automotive	$13,038,000	$37,896,000	$3,381,000	$8,604,000	$53,691,000	$25,848,000	$142,458,000
Banks	6,939,000	79,770,000	6,255,000	13,791,000	46,431,000	16,935,000	170,121,000
Apartments	39,879,000	284,931,000	19,077,000	28,881,000	163,779,000	42,810,000	579,357,000
Apartment hotels	15,030,000	69,270,000	7,275,000	14,670,000	75,165,000	21,945,000	203,355,000
Clubs (fraternal, etc.)	31,020,000	107,028,000	7,455,000	13,689,000	121,317,000	41,283,000	321,792,000
Community, memorial	7,023,000	24,054,000	765,000	3,765,000	14,454,000	10,971,000	61,032,000
Churches	22,389,000	106,740,000	16,905,000	37,494,000	150,063,000	39,885,000	373,476,000
Dwellings (under $20,000)	15,837,000	109,281,000	10,809,000	11,904,000	64,497,000	23,394,000	235,722,000
Dwellings ($20,000 to $50,000)	9,303,000	36,636,000	6,594,000	5,622,000	31,086,000	12,699,000	101,940,000
Dwellings (over $50,000)	4,710,000	21,717,000	1,620,000	4,635,000	15,036,000	7,812,000	55,530,000
Hotels	33,615,000	95,874,000	31,710,000	19,035,000	160,824,000	52,635,000	393,693,000
Hospitals	13,620,000	88,770,000	4,980,000	17,448,000	61,395,000	42,825,000	229,038,000
Industrial	37,770,000	115,089,000	7,191,000	13,698,000	178,050,000	40,569,000	392,367,000
Office buildings	39,303,000	222,441,000	12,426,000	36,039,000	103,359,000	75,051,000	488,619,000
Public buildings	8,103,000	51,981,000	4,911,000	12,666,000	51,510,000	57,930,000	187,101 000
Schools	79,335,000	263,784,000	27,291,000	51,687,000	229,641,000	75,120,000	726,858,000
Stores	15,630,000	45,030,000	4,965,000	6,708,000	41,685,000	23,220,000	137,238,000
Theaters	24,450,000	36,495,000	4,944,000	8,484,000	40,512,000	21,096,000	135,981,000
Welfare (Y. M. C. A., etc.)	1,353,000	18,417,000	1,305,000	6,171,000	15,096,000	14,298,000	56,640,000
Total value of new buildings	$418,347,000	$1,815,204,000	$179,859,000	$314,991,000	$1,617,591,000	$646,326,000	$4,992,318,000

TABLE II—COMPARISON BETWEEN THE YEARS 1924 AND 1925 OF PERCENTAGE OF PUBLIC DEMAND FOR NEW BUILDINGS

Compiled by the *Architectural Forum*

Type of Building	Northeastern States		North Atlantic States		Southeastern States		Southwestern States		Middle States		Western States		United States	
	1924	1925	1924	1925	1924	1925	1924	1925	1924	1925	1924	1925	1924	1925
Automotive	4.4	3.2	3.1	2.0	1.8	2.0	2.0	2.8	2.4	3.3	1.8	4.0	2.6	2.9
Banks	6.9	1.6	4.9	4.4	3.2	3.4	1.8	4.4	3.1	2.9	2.0	2.6	3.7	3.3
Apartments	8.1	9.5	12.7	15.6	8.2	10.6	6.0	9.1	8.0	10.1	16.0	6.6	9.8	10.2
Apartment hotels	7.2	3.6	6.3	3.8	2.1	4.1	1.0	4.7	8.6	4.6	5.0	3.4	5.0	4.0
Club and fraternal	5.4	7.4	4.4	5.9	6.1	4.1	6.0	4.3	6.8	7.5	4.9	6.5	5.6	6.0
Community and memorial	0.7	1.7	1.6	1.3	0.7	0.4	2.2	1.1	0.9	0.9	2.8	1.6	1.5	1.2
Churches	5.1	5.4	4.8	5.9	6.9	9.4	7.0	11.9	4.8	9.2	5.9	6.3	5.8	8.0
Dwellings (under $20,000)	4.2	3.8	6.3	6.0	3.8	6.0	4.2	3.8	2.7	3.9	3.2	3.6	4.1	4.5
Dwellings ($20,000 to $50,000)	2.7	2.2	3.0	2.1	2.4	3.6	2.5	1.7	1.4	1.9	1.2	1.9	2.2	2.2
Dwellings (above $50,000)	2.6	1.1	1.8	1.3	0.9	0.9	1.9	1.4	0.8	0.9	1.3	1.2	1.6	1.1
Hotels	6.1	8.1	9.5	5.4	23.6	17.6	15.9	6.0	11.8	10.0	11.0	8.0	13.0	9.2
Hospitals	3.4	3.3	5.7	4.9	3.4	2.8	6.9	5.6	6.2	3.9	4.6	6.7	5.0	4.5
Industrial	8.2	9.1	10.1	6.3	4.7	4.0	2.8	4.4	7.7	11.0	4.7	6.3	6.5	6.9
Office buildings	4.5	9.4	7.0	12.2	7.1	6.9	13.1	11.4	9.2	6.3	13.3	11.6	9.0	9.6
Public buildings	2.3	1.9	1.3	2.9	2.7	2.7	6.4	4.2	2.8	3.2	3.3	8.9	3.1	4.0
Schools	18.4	18.9	12.9	14.5	19.1	15.2	11.4	16.4	15.4	14.2	12.5	11.6	15.0	15.1
Stores	1.8	3.7	2.1	2.5	1.8	2.8	1.3	2.1	3.1	2.7	2.7	3.6	2.1	2.9
Theaters	7.0	5.8	1.8	2.0	1.0	2.8	6.9	2.7	3.7	2.6	2.3	3.4	3.8	3.2
Welfare (Y. M. C. A., etc.)	1.0	0.3	0.7	1.0	0.5	0.7	1.7	2.0	0.6	0.9	1.5	2.2	1.0	1.2

building shortage of considerable magnitude confronting the industry. In cities of more than ten thousand population alone it was said that this shortage is in excess of $4,000,000,000, with a very large apparent shortage in places of less than ten thousand population.

In certain districts the building shortage has to a considerable extent been met, but at present building costs the normal expenditure required in this country is approximately three and a half billion dollars, so that even at the five-billion-dollar rate it will still take several years of more than normal activity to meet the requirements of the shortage which accumulated in the period from 1913 to 1920.

Speaking of general business conditions and of the building situation, Secretary Hoover, in a recent statement on the economic prospects for the year 1925, says in part: "The construction work of the country has maintained high activity. While the shortage, particularly of housing and business buildings, due to the cessation of construction during the war has been to a large degree overcome, yet continued high real wages and general prosperity create a demand in excess of that due only to increasing population, because of the insistence of a population with rising standards of living upon more elbow room and better housing generally."

Scope of Board of Tax Appeals Covered in Textbook

In order that American industry may be informed of the scope and action and decisions of the recently established United States Board of Tax Appeals, a textbook covering the subject, prepared by the National Association of Manufacturers, has been distributed to its members, who compose the heart of industrial America. This booklet is a complete analysis of the board's powers and jurisdiction, gives a digest of more than a hundred typical cases before the board showing the almost limitless scope of the facts that will come before such a board, and outlines in great detail the various forms that have been prescribed for use before this new tribunal.

In a foreword to the booklet Charles D. Hamel, chairman of the new board, says in part: "To students of the financial and economic condition of our people there is no recent development of greater interest and of more practical importance than the establishment of the United States Board of Tax Appeals. What it has done and is doing and what it has before it in the future are of the greatest interest to business men."

National Standardization

Pan-American Conference Proposes a National Body in Each Republic—Metric Victory Won

THE organization of some form of a national standardizing body in each of the American republics was one of the formal proposals of the first official Pan-American conference on standardization recently held in Lima, Peru, according to a report to the American Engineering Standards Committee by Albert W. Whitney, who served as chairman of the United States government delegation. Mr. Whitney reported that standardization is not yet developed in any of the Latin-American countries on an organized basis, and it was the belief of the conference that the subject would play an important part in the future of these countries, first, in making more efficient and expediting their industrial organization; second, in simplifying and clarifying international trade, and third, and most important, in the development of better methods of producing and marketing their products.

The recommendations of the conference, which was an official body representing thirteen countries, were made to the Inter-American High Commission and to the twenty-one American Republics represented on it. The report states that "the tangible and formal results of the conference were the signing of a set of resolutions by the duly accredited representatives which provided for the development and promotion of standardization work by the various countries and for the development of such work on an international basis. The relation of such work and its development on an international basis was intrusted to the Inter-American High Commission. Provision was made for holding the next conference, either two or three years hence, in the United States. It is believed that the Lima conference and the work of the Inter-American High Commission will be effective in bringing about a very considerable degree of standardization work among the Latin-American States at once."

In connection with uniformity of weights and measures, action favorable to metric standardization was taken. By resolution it was urged "that the units of weights and measures in the various countries tend toward the decimal metric system." The United States of America, represented at the conference by an official delegation, is included in the recommendation. All the other American republics are already on the metric basis. New specifications and changes in those now existing are to be in terms of the metric units throughout the Western Hemisphere as soon as the program of the Lima

conference is carried into effect. In the meanwhile it is recommended that metric equivalents be used in catalogs and other commercial literature to aid the transition to world-uniform measures. That the metric topic will be prominent again upon the program of the second Pan-American standardization conference was assured by the establishment of a committee on uniformity of weights and measures which will investigate and report at that conference. All the twenty-one American republics, besides the United States, will have representatives on this committee, to be appointed by the Inter-American High Commission, with headquarters in Washington.

Business Conditions

CONSUMMATION of consolidation plans of central-station companies is resulting in a consistent program of expansion and interconnection. Recent orders received by two manufacturers for switching equipment amount to about $100,000 and consist mainly of apparatus for 132-kv., 110-kv. and 66-kv. service. An order recently placed also calls for about $325,000 worth of power transformers for use in a Pennsylvania development. Steel mills are actively purchasing electrical equipment, and many requests for quotations are being received. While activity is frequently reported in the transmission-line field, sales of distribution-line equipment are good. A manufacturer of insulators reports the sale of 150,000 small porcelain insulators for use on the distribution lines of a Michigan utility.

The Westinghouse Electric International Company has announced the receipt of an order for $2,000,000 from the Tokio Electric Light Company, Japan, for high-tension electrical equipment. An inquiry for about $40,000 worth of transformers for shipment to Mexico is also in the market at the present time. New properties are being opened up by mining companies in South America, and from these sources good inquiries are being received by manufacturers of electrical apparatus.

In the New England district sales of some industrial products continue to hold up well. There is an encouraging demand in that territory for small industrial furnaces, and motors also are in good demand. Central-station companies are purchasing transformers and switching equipment in the New York district, and small motors are being sold in good volume. In the Southeast sales are quiet except in Florida and around Birmingham. Much building construction is under way in that district. There is renewed activity in construction work in the Middle West, with a good demand for high-tension equipment and pole-line hardware. On the Pacific Coast business is spotty. Lumber prices are becoming stabilized, and conditions in that field are better so that producers are again considering electrification plans previously deferred.

Building Activity Continues Close to Last Year's Rate

BUILDING activity continues to run very close to the rate established in the early part of last year, according to the F. W. Dodge Corporation. February building contracts in the thirty-six Eastern states (which include about seven-eighths of the total construction volume of the country) amounted to $299,260,000. This was very slightly under the figure for February of last year and less than 1 per cent over the figure for January of this year. The combined total for the first two months of this year, $595,653,000, shows a decline of one-half of 1 per cent from the first two months of last year.

Although the total building volume of the two years has been running so close, there has been a shifting of activity as to localities and as to classes. There has been a decided falling off in New York State and northern New Jersey, a slight decrease in the Northwest, a slight increase in the Central West and substantial increases in New England, the Pittsburgh district and the Southeast. Public works and utilities contracts have increased considerably, taking up the slack in other classes of construction.

Last month's total of $299,260,000 included $136,023,200, or 45 per cent of all construction, for residential buildings; $52,865,200, or 18 per cent, for public works and utilities; $38,825,100, or 13 per cent, for commercial buildings; $20,767,200, or 7 per cent, for industrial buildings and $20,278,000, or 7 per cent, for educational buildings. Contemplated new work reported last month amounted to $666,700,600. This was an increase of 4 per cent over the amount reported in January and of 32 per cent over February of last year.

Prices Decline Further in Non-Ferrous Metal Market

ONE producer characterized the past week as the dullest in his experience. This inactivity is ascribed principally to the setback in the stock and grain markets and the easier feeling in some businesses. The London metal market has also become weaker and has naturally had a strong influence on the markets here. Despite this, fair-sized sales of all the non-ferrous metals were made, but usually at concesssions.

Outside of one good sale in the Detroit district and a small volume of business transacted in the Connecticut Valley, the copper market was quiet. Copper was bought at 14¼ cents delivered on Thursday and Friday last week, but on Monday, with lower quotations from London, consumers became reluctant to place any tonnages at that price.

On Tuesday a cut of ¼ cent was made and a moderate amount of copper was sold. Even this price did not hold for long, so that it was possible to obtain the metal from several directions at 14¼ cents on Wednesday, with the prospect that even that quotation might be shaded.

The American Smelting & Refining Company continues its contract price for lead at 9 cents. Moderate tonnages have been sold all week for 9 cents, New York, and apparently no producers are disposed to cut this price, despite rumors that slight concessions have been possible in the last two days. A prominent consumer, whose lead goes into various channels, used almost exactly the same amount of lead in January and February that he did in the same months of last year. This indicates that enlarged production and lowering stock have been the reasons for the easier condition of the market, rather than diminished consumption. In common with the other non-ferrous metal, zinc sales were poor. Consumers do not seem interested in the market. The tin market was quiet until Tuesday, when some interest was aroused in consumers by a reduction in prices. A premium on forward deliveries has ruled in London, but sellers here have not been able to obtain it.

NEW YORK METAL MARKET PRICES

	Mar. 11, 1925 Cents per Pound	Mar. 18, 1925 Cents per Pound
Copper, electrolytic	14.45	14¼
Lead, Am. S. & R. price	9	9
Antimony	16¼	15½
Nickel, ingot	31	31
Zinc, spot	7.65	7.60
Tin, Straits	53¼	53
Aluminum, 98 to 99 per cent	28	28

Small Industrial Furnaces Selling Well in New England District

SALES of some electrical products continue to hold up well in New England and in a few special fields show exceedingly strong trends, but this cannot be said to be general. There is an encouraging demand for small industrial furnaces. A manufacturer in Rhode Island reports such an unusual activity that he is three weeks behind in deliveries. Several installations of furnaces have been made throughout Massachuetts, owing in part to a revival of the tool-making and metal industries in that district. Small motors continue to sell well. One manufacturer points to a distinctive demand throughout New England and shows a gain of 40 per cent in sales for the period to date as compared with a corresponding period in 1924—a volume much in excess of other district sales of his company. Sales of meters and transformers compare favorably with sales in 1924 for the same period. A manufacturer in Connecticut is reported to be in the market for a number of power transformers amounting to 4,829 kva.

Jobbers report sales to be dull, the situation being, in the opinion of many, influenced by the uncertainty of wage adjustments which are pending in several communities in New England. One central-station group shows striking gains in sales of electrical appliances. For the week ended March 7

sales amounted to $110,930, as compared with $63,217 for a corresponding period in 1924. Radio sales are reported to have dropped off considerably. Several small industrial sales, amounting to about $6,000 and consisting of small motors, exciters, and power apparatus, were announced by a prominent jobber. A Massachusetts central-station company, after a special drive for old-house wiring, closed contracts totaling $12,687.47 for the month of February.

Sales Show Upward Trend in New York District

SALES of transformers and switching equipment to central-station companies are reported in good volume in the New York district. One company has purchased approximately $325,000 worth of power transformers for a Pennsylvania development, and orders for about $96,000 worth of switching equipment have recently been placed. Another order for two 1,000-kva., 33,000-volt transformers has also been closed. February sales have been reported as good with the trend upward. The largest volume of buying is expected in April. Buying by industrial plants is in good volume. Many sales of small general-purpose motors are being made. One manufacturer has just closed two orders amounting to about $12,500, covering synchronous and induction motors.

Some very good inquiries have been received from mining companies for electrical apparatus to equip new properties that are being opened up in South America. Sales of control apparatus to the printing industry are said by one manufacturer to have recently been good. Several interesting export inquiries have also been received for transformers and transmission towers, although in the latter case European competition is very keen. Jobbers report an even demand for building construction material. Sales by them are generally said to be slow. Buying of radio apparatus has also shown a marked decrease. Preliminary fan orders are said to be good.

Renewed Activity in Construction Work in the Middle West

VARIOUS central-station companies are purchasing apparatus in the Middle West and there is a renewed activity in construction work. One company purchased a large battery of boilers and also placed smaller orders for circuit breakers, meters and transformers. There has been a good demand for high-tension equipment and pole-line hardware. A considerable quantity of busbar copper has been purchased, and producers report an increase in inquiries received.

Jobbers have had rather good sales. The volume of business has not been so good as it was expected to be, but sales apparently are increasing and are well diversified. Increased activity in the southern Illinois coal mines has resulted in better sales for a number of the Chicago jobbers. There was a brisk demand for conduit and wiring devices, several large contractors in the Chicago district having placed orders for their spring requirements.

Business Spotty on Pacific Coast—Lumber Conditions Improving

BUSINESS on the Pacific Coast has been characterized by an alternation of busy and dull weeks. Sales in the rural district are not expected to be better than average until crop money is received. Line material and radio supplies predominate in the ordering. Recent power company orders include 2,000 line switches from Los Angeles and 400 from Spokane, the latter being for 15,000-volt service. Some good pole and pole hardware sales have been made to mines and lumber companies. Government and state hospitals have been in the market for miscellaneous lots of wiring material. Radio sales have been fair, but dealers report a tendency to postpone purchase of higher-priced sets because of the prevalent expectation of a midyear decreases in prices.

Rigid iron-conduit sales are brisk, especially in the larger sizes, it having been reported that there is a shortage of the galvanized type in the 2½-in. size. An important meeting of inspectors is to be held in San Francisco in the latter part of March, at which time will be considered the extension to other cities of the present Oakland wiring regulations concerning open terminals and dead-front panel cutouts. In the Northwest lumber prices are stabilizing and orders are increasing, so that with business returning to normal lumber producers are more optimistic and are again considering electrification plans or addition to electrical installations on which action was deferred some weeks ago when business began to show a decrease. Range washing-machine and appliance sales are reported good and on the increase in that section.

Sales in the Southeast Quiet Except in Certain Sections

WITH the exception of the State of Florida and the Birmingham district, sales in the Southeast for the past few weeks have been quiet. In the former territory considerable central-station expansion is reported, and 150 miles of high-tension lines is projected for early construction. High-tension transformers in capacities of 11,000 volts to 38,000 volts are moving reasonably well, with oil switches of similar ratings in proportional demand. A contract has recently been let for the construction of the Lake Lure dam and power plant at Chimney Rock, N. C., the total cost approximating $700,000, and orders for all materials have just been placed. A contract has also been awarded for the new shops of the Clinchfield railway at Erwin, Tenn., to cost approximately $500,000.

Building construction started in nine Southeastern states during February amounted to nearly $47,000,000, an increase of 14 per cent over January. A considerable portion of this is being undertaken in Miami, Fla., and vicinity. These construction activities are expected to stimulate purchases by contractor-dealers, which on the whole have been unsatisfactory since the first of the year. With few exceptions, retail dealers report that spring activities have not yet got under way, but a feeling of optimism prevails.

Activities of the Trade

Ajax Electrothermic Corporation Announces Recent Sales

The Ajax Electrothermic Corporation, Trenton, N. J., announces the recent sale of one 35-kva. Ajax-Northrup high-frequency converter with small high-frequency induction furnaces to each of the following institutions: Bureau of Standards, Washington, D. C. (the fourth unit); General Electric Company, West Lynn, Mass. (the fourth unit); Vanadium Corporation of America, Bridgeville, Pa.; the Thermal Syndicate, Ltd., Neptune works, Wallsend-on-Tyne, and Post Office Research Station, Dollis Hill, London.

The last two units mentioned are being manufactured in England by the Ajax company's representative and licensee, the Electric Furnace Company, Ltd., London. During the past year the Electric Furnace Company has supplied eighteen 35-kva. Ajax-Northrup units to the Gutta-Percha Company, Ltd.

Westinghouse International Receives Japanese Order

The Westinghouse Electric International Company has received through Takata & Company an order for high-tension electrical equipment from the Tokio Electric Light Company for $2,000,000, which will provide another 50,000 kw. of energy for the city of Tokio.

Capacity has been provided at the two Tokio substations for 120,000 kw., and these power outlets will be later enlarged to 180,000 kw. If the new steam-power plant which is being built at Senju is included, the available power for Tokio will be increased to 230,000 kw. Hydraulic stations for the first installation are being built on the Nippashi River and future stations will be built on the Nagase River.

Electric Truck Delivery Exhibit Held in New York City

With exhibits by all of the manufacturers of electric delivery trucks, electric passenger cars, storage batteries and accessories, the fifth annual electric truck show, held in the showrooms of the New York Edison Company, Irving Place & Fifteenth Street, this week was national in character, both for the reason that all of the manufacturers were represented and because the show was prepared with this feature in view.

The models exhibited ranged in size from 1,000 lb. to 7½ tons and were shown by the following companies: The Autocar Company, the Commercial Truck Company, the Electruck Corpo-

ration, the Lansden Company, Inc., the O. B. Electric Vehicles, Inc., the Steinmetz Motor Car Corporation, the Walker Motor Vehicle Company and the Ward Motor Vehicle Company. Other exhibitors included the Detroit Electric Car Company, the Rauch & Lang Corporation, the Edison Storage Battery Company, the Electric Storage Battery Company, the General Lead Batteries Company, the K. & W. Battery Company, Inc., the Philadelphia Storage Battery Company, the Putnam Storage Batteries, the A. & J. M. Anderson Manufacturing Company, the Allen-Bradley Company, the Cutler-Hammer Manufacturing Company, the General Electric Company, Hammacher Schlemmer & Company, the Sangamo Electric Company, the Vacuum Oil Company and the Westinghouse Electric & Manufacturing Company.

The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, manufacturer of electrical measuring instruments, has awarded a contract for the erection of a two-story factory addition to cost about $60,000.

The Electric Storage Battery Company, Nineteenth Street and Allegheny Avenue, Philadelphia, has preliminary plans under way for the construction of a one-story addition, 80 ft. x 245 ft., reported to cost about $75,000.

The Standard Turbine Corporation, Scio, N. Y., announces the appointment of Howell Ross Hanson, 2200 Packard Building, Philadelphia, as its district representative.

The General Insulate Company, 1008 Atlantic Avenue, Brooklyn, manufacturer of "Insulate" and "Hi-Heet," is now engaged in making extensive additions to its plant to provide additional facilities for taking care of its constant growth.

The Universal Crane Company, Swetland Building, Cleveland, has appointed the Factory Products Company, 204 Oliver Building, Pittsburgh, as its representative for the Pittsburgh territory. W. W. Adams, president of the Factory Products Company, has been identified with the sales of locomotive cranes in that section since 1907.

The United Electric Company, Canton, Ohio, manufacturer of stationary and portable electric cleaners, announces a contest for appliance dealers in which more than $1,000 in prizes is being offered for the best suggestions from dealers on the subject of dealer or sales helps that the dealer believes will be most helpful in stimulating sales.

The Circle F Manufacturing Company, Trenton, N. J., manufacturer of wiring devices, etc., has plans under way for the erection of a two-story factory addition, to cost approximately $40,000.

The Peerless Light Company, 663 West Washington Boulevard, Chicago, manufacturer of lighting fixtures, announces that Oscar Reinhold, general manager of the lamp and shade division, is now in Europe making purchases. Leon Cahn has been placed in charge of the New York office, succeeding Abraham Herskovitz, who is now in Chicago in charge of the creative and production department. Herbert Kahn has been placed in charge of the fixture division. F. A. Long, W. M. Darling, Bert Day, B. M. Cohen and C. J. Klotz have been appointed lamp salesmen in the lamp and shade division, and Ray Johnson, B. H. Schwartz and G. Phillips have been added to the general sales force.

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., manufacturers of wiring devices, announces a new pull-chain canopy switch, known as the "P. & S. 3316," which has a very smooth, easy action. The switch is rated at 3 amp., 125 volts, or 1 amp., 250 volts.

The Westinghouse Electric & Manufacturing Company has received an order for more than $100,000 from the New York Edison Company for a number of large transformers and thirteen induction regulators.

The Atwater Kent Manufacturing Company, Philadelphia, manufacturer of radio and electrical apparatus, has taken title to a tract of land at Abbottsford Avenue and McMichael Street, approximating 8 acres, and will use it for proposed extensions. The company has recently taken bids for a one-story-and-basement addition to its plant.

New Equipment Available

Convertible Power Panel

A new power panel construction embodying convertible features in panelboard design has been announced by the Square D Company, Detroit. Individual insulating bases set into slots in a steel grid make it possible at any time to adjust fuse jaw spacings to provide for either 30, 60 or 100-amp. fuses. Fuse jaws, connectors and solder lugs are mounted on the individual insulating bases, permitting their removal from the front of the panel in a few minutes' time by means of a screwdriver. The construction is such that three-wire circuits can quickly and easily be converted into two-wire and vice versa. A split gutter wall, half of which is made removable by loosening several screws, makes it easy to have access to the circuit wires, so that it is unnecessary to remove the heavy doors and side trims. These panels are available in circuits of four or multiples of four and are supplied for 220, 440 or 600-volt service.

Limit Switch

A new limit switch of the small-size geared type for window-opening service or similar applications has been designed by the General Electric Company. It operates on the traveling-nut principle. Damage to the switch resulting from overtravel of the motor is prevented by allowing the traveling nut to leave the worm at the extreme ends. The nut is automatically reengaged by means of a compression spring when the direction of rotation is changed.

The switch is completely inclosed and is for use on 230 volts direct current or 550 volts alternating current.

Refractory Gun

For relining, patching or surfacing furnace walls a portable refractory gun has been developed by the Quigley Furnace Specialties Company, 26 Cortlandt Street, New York. Refractory materials of plastic consistency can be applied with this gun, which is operated by compressed air. The use of this gun enables quick repairs or hot patching of furnace walls or baffles in places not easily reached by hand-patching methods. Pre-mixed refractory material is placed in the gun. The nozzle is then pointed at the place to be repaired, and the gun operation, by handling the valve controls, forces the mixture from the gun through a section of hose to the nozzle, where the repair man makes the application.

The pressure required will vary from 90 lb. to 100 lb., depending on the nature of the material. For heavy plastic mixtures pressures from 95 lb. to 100 lb. are used, and for thin mixtures work has been done at a pressure as low as 50 lb. When not required for furnace repair work the gun can be used about the plant for rough whitewashing, spraying paint or handling plastic mixtures such as stucco.

Expansion Shield.—A new type of expansion shield called the "Dryvin" has been developed by the Star Expansion Bolt Company, New York. With this shield the fixture itself can be used as a templet, and a nail quickly driven home replaces the usual bolt or lag screw. These new shields are made in several sizes from $\frac{3}{16}$ in. x $\frac{3}{4}$ in. to 1 in. x 2¼ in.

Weatherproof Connector. — An armoured weatherproof connector known as the "Ohio" has been developed by the Ohio Electric & Controller Company, Cleveland. It has a rating of 150 amp. continuous service. It can be connected or disconnected instantly, requiring no tools or tape, and when connected it is held by a double bayonet lock. Butt contacts are secured by a 20-lb. spring pressure and may be compared to a solenoid switch or circuit-breaker contact. A 15-deg. wipe keeps the contacts clean. They are well covered when open as well as closed.

Buffing and Polishing Machine.—An extra heavy-duty double spindle and a heavy-duty single spindle buffing and polishing machine have recently been placed on the market by the Cleveland Armature Works, Cleveland. Both of these machines are chain-driven by alternating-current motors, designed for the particular service, set close to the spindles. They are available for either 25-cycle or 60-cycle service. The double-spindle unit is provided with two motors, each spindle being entirely independent mechanically and electrically. Both machines are equipped with Timken tapered adjustable roller bearings. Control of the unit is through an oil circuit breaker and a push-button mounted on the machine.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in India (No. 14,093) of electrical goods, including switches, armature wires, cables, fans, shades, heating and cooking appliances, telephones and accessories.

An agency is desired in Australia (No. 14,095) for lighting plants for farms and residences.

An agency is desired in Egypt (No. 14,069) for safes fitted with electrical burglar alarms.

An agency is desired in Java (No. 14,094) for radio sets and parts.

New Trade Literature

BALL BEARINGS.—A booklet describing the "Super-Strom" ball bearings from the viewpoint of design, dimensions, material, workmanship and load-carrying capacities has been issued by the Strom Ball Bearing Manufacturing Company, 4527 Palmer Street, Chicago. The booklet contains tables covering the 200 series, 300 series and 400 series of radial bearings and contains complete dimension information and capacity in pounds at various revolutions per minute.

SAFETY SWITCHES, WIRING DEVICES, SWITCHBOARDS, ETC.—The Trumbull Electric Manufacturing Company, Plainville, Conn., has issued catalog No. 13, describing its "Circle T" products. It contains 200 pages and is divided into four sections: (1) Listing its line of safety and externally operated switches; (2) open knife switches and accessories; (3) battery switches and other porcelain devices; (4) panelboards and accessories. It is also issued in loose form for jobbers and salesmen's data book, and is furnished in a leather cover for purchasing agents and inside service men.

VIBRATORS.—The P. A. Geier Company, 540-560 105th Street, Cleveland, is distributing a booklet entitled "For Health, Strength and Beauty," describing and illustrating the various types of the "Royal" vibration. Attention is also called to the Royal "Therm-Air" dryer.

FRACTIONAL HORSEPOWER MOTORS.—A folder issued by the Century Electric Company, St. Louis, describes the Century wool yarn system of lubrication for fractional horsepower motors. It contains a short sketch on motor lubrication from the time of the grease cup to the present day and calls attention to some of the advantages of the wool-yarn system of lubrication.

MEASURING INSTRUMENTS. — Catalog No. 15 issued by the Jewell Electrical Instrument Company, 1650 Walnut Street, Chicago, contains a complete line of its alternating-current and direct-current switchboard instruments, which have been developed for central-station requirements. The data included are designed to aid in the application of the instruments.

INSULATOR.—"Our 50th Year" is the title of a booklet issued by R. Thomas & Sons Company, East Liverpool, Ohio, in which it gives an outline of the company's activities in the electrical industry since it was established in 1873. Illustrations are given showing the Thomas plant in 1873, 1889 and the present works, also of the first "Hi-Tension" insulator and other early types of insulators.

EVAPORATORS. — "Wheeler Evaporators" is the title of a catalog issued by the Wheeler Condensing & Engineering Company, Carteret, N. J., which contains a discussion of apparatus for the production of distilled water for boiler feed make-up. Illustrations and diagrams are given showing various installations of the Wheeler evaporator.

EXTERIOR LIGHTING FIXTURES.—The Union Metal Manufacturing Company, Canton, Ohio, has issued catalog No. 54, covering its exterior lighting fixtures. Illustrations and specifications are given of ornamental units for lighting and decorating entrances to churches, schools, office buildings and all types of public and municipal buildings; also for lighting of residences, private grounds, estates and for bridge lighting.

HIGH-FREQUENCY MACHINE.—The General Engineering & Supply Company, Therapeutical Division, 160 Fifth Avenue, New York City, is distributing bulletin Q 48, covering the "Gesco" portable high-frequency machine for use in hospitals, doctors' offices and in homes of patients.

BOILER-ROOM OPERATION.—"Boiler Efficiency" (Article 4) is the title of one of a series on boiler-room operation issued by the Republic Flow Meters Company, 2240 Diversey Parkway, Chicago. It contains curves showing the development in steam-boiler economy and a table giving the typical heat balance using bituminous coal.

New Incorporations

THE BLACK RIVER POWER & DEVELOPMENT COMPANY, Poplar Bluff, Mo., has been incorporated by W. H. Meredith, Poplar Bluff, and associates. The company is capitalized at $75,000 and proposes to build a large hydro-electric development on the Black River.

THE NATIONAL ELECTRIC POWER COMPANY, Portland, Me., has been incorporated with a capital stock of $6,000,000 to generate and distribute electricity. M. F. Foster, South Portland, Me., is president of the company.

THE KNIGHTLY LIGHT & POWER COMPANY, Fort Defiance, Va., has been incorporated with a capital stock of $10,000. The officers are: T. J. Roller, president, and M. W. Garber, secretary.

Construction News.

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

GILMANTOWN, N. H. — The Public Service Commission has granted the Twin State Gas & Electric Company, Brattleboro, Vt., permission to supply electricity in the towns of Gilmanton, Branstead and Northwood, at present without electric service. The company plans to extend its transmission lines from Brattleboro.

FORT WARREN, MASS.—Bids will be received by the Quartermaster Boston Harbor until March 22 for installing alternating-current substation equipment at the local substation and at Fort Strong. Post office address Boston.

RUTLAND, MASS.—Bids will be received by the Construction Division, United States Veterans' Bureau, Washington, D. C., until March 31, for the installation of a ground lighting system at local hospital No. 89, for installing a fire alarm system.

Middle Atlantic States

DANSVILLE, N. Y.—The installation of a fire-alarm system, to cost about $10,000, is under consideration by the Village Board.

FREDONIA, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, has secured a site on Water Street on which it proposes to erect a building, which will be used as headquarters for this vicinity, store house and substation.

GREENWICH, N. Y.—The Consolidated Electric Company has petitioned the Public Service Commission for authority to extend its lines to Victory Falls and for approval of franchise for furnishing electricity there.

NEW YORK, N. Y.—Bids will be received by the Commissioner of Purchase of the City of New York, Municipal Building, until March 25 for furnishing incandescent lamps, electric materials and supplies, copper and weatherpoof wire to Bellevue and Allied Hospitals, the Police Department and the Department of Docks and Plant and Structures for a period ending June 25, 1925.

PRATTSBURG, N. Y.—Application has been made to the Public Service Commission, by the New York Central Electric Corporation, Perry, for permission to extend its transmission lines to Prattsburg and for approval of franchise granted by the Village Board.

ROCHESTER, N. Y.—The construction of new underground conduit systems in Atwell Street and Lake Avenue, to cost about $50,000, is under consideration by the Rochester Telephone Company.

ROME, N. Y.—Right of way is being secured by the Northern New York Utilities Inc., Watertown, for a transmission line from the substation in Rome to the substation in Lee Center.

SCHODACK LANDING, N. Y.—Arrangements are being made by the Schodack Light & Power Company, Castleton, to extend its transmission line to Schodack Landing. Twenty-six street lamps will be installed here.

WATERTOWN, N. Y.—Negotiations have practically been completed by the Power Corporation of New York, which controls the Northern New York Utilities Corporation, Inc., for the purchase of three paper mills at Glen Park and Brownsville with their power rights on the Black River, from the International Paper Company. The project includes the construction of a large canal diverting the course of the entire Black River, from the No. 4 mill at Glen Park to the C. R. mill at Brownsville, resulting in a 90 to 97-foot head and developing 25,000 to 30,000 hp.

HIGHTSTOWN, N. J. — The Eastern New Jersey Power Company, Asbury Park, has secured permission to acquire the properties the Electric Light & Power Company of Hightstown, and the Jamesburg (N. J.) Electric Company. Extensions in transmission lines in these districts are contemplated.

NEW BRUNSWICK, N. J.—Steps have been taken by the French Street Merchants and Property Owners Association to secure an ornamental lighting system for that thoroughfare.

NORTH BERGEN, N. J. — Charles Miller & Company plans to build a power house in connection with their proposed new meat-packing plant, to cost about $130,000. Himmelsbach & Schlich, 136 Liberty Street, New York, are architects.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company, plans to build a transmission line from Hazleton, to supply commercial service at Oneida and Tohickon.

CHESTER, PA.—The Ford Motor Company, Detroit, it is reported contemplates the construction of a power plant at its proposed local assembling works, to cost about $1,000,000. The company has acquired the local property of the Merchant Shipbuilding Company for the new works.

LEMOYNE, PA.—The Harrisburg (Pa.) Light & Power Company is negotiating for the purchase of the system of the United Electric Company.

MERCER, PA.—The Reznor Manufacturing Company plans to electrify its entire plant, replacing steam power, in connection with a general improvement program now under way.

PITTSBURGH, PA. — The Board of Trade, Hazelwood district, is negotiating with the City Council for an improved lighting system on Second Avenue, Hazelwood.

WEATHERLY, PA. — The Borough Council has authorized estimates of cost for an addition to the municipal electric power plant, to include installation of a generating unit and accessory equipment.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 24, for one electrically operated fresh water pump for the local navy yard (Schedule 3454).

BALTIMORE, MD. — Bids will be received by the Board of Awards, until March 25, for lamp posts, as per specifications on file at the office of the Board of Park Commissioners.

CHARLESTON, W. VA.—The Gauley Power Company, Union Building, has been granted a preliminary permit for a hydro-electric power project on the Gauley and Meadow Rivers, to develop about 50,000 hp.

FAIRMONT, W. VA.—The Monongahela West Penn Public Service Company contemplates extensions and improvements, to cost about $1,000,000, to include the construction of a local substation, extension of transmission lines, etc.

STRASBURG, VA.—Plans are under way by the Northern Virginia Power Company, Winchester, which was recently awarded a contract for street-lighting here, to install a local plant to furnish the service.

WASHINGTON, D. C.—Bids will be received by the Chief Engineers, United States Army, Washington, until April 2, for 7,125 ft. electric power cable.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United

States Army, Washington, until March 30, for radio transmitters in lots of 50, 75, 100 and 150 (Proposal C. P. 19005-2).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until March 24, for 5,000 ft. lighting and power wire, and 28,000 ft. telephone cord, for the Mare Island navy yard; and for 5,000 ft. lighting wire for the Puget Sound yard (Schedule 3426).

North Central States

CASS CITY, MICH.—The Michigan Electric Power Company, Bad Axe, has tendered an offer for the municipal power plant, and proposes to extend its transmission line here.

DETROIT, MICH.—Plans have been prepared by the Department of Public Works for 744 protected and lighted safety zones on Woodward, Jefferson, Grand River, Michigan, East and West Warren Avenues, Forest Avenue West and Fort Street West, to cost about $483,600. G. Jerome is city engineer.

IRONWOOD, MICH. — The Oliver Iron Mining Company plans to build a concrete stack, 10 ft. in diameter and about 275 ft. high at its power plant.

WATERVLIET, MICH.—The City Council is negotiating for the purchase of a power site for the proposed municipal hydro-electric power plant, to cost about $100,000.

CLEVELAND, OHIO.—A resolution authorizing the installation of an ornamental lighting system on Euclid Avenue between Ivanhoe Road and the city limits has been introduced to the City Council.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 27 for furnishing and installing electrical equipment complete in the police headquarters building.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 27 for series multiple transformers for the Division of Light and Power. Bids will also be received at the time and place for weatherproof copper wire.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 1 for "Mazda" lamps for the various departments of the city, Board of Education and Public Library for all the lamps required for a period of one year in the amount of approximately $50,000.

DOVER, OHIO.—The City Council has appropriated $51,000, for extensions and improvements in the municipal electric plant, including the installation of a 750-kw. generating unit.

LIBERTY CENTER, OHIO. — The installation of a municipal electric light and power plant is under consideration by the Board of Village Trustees.

LISBON, OHIO.—The Board of County Commissioners plans to build an addition to the lighting system at the county home. John P. Neill is superintendent of the institution.

LOUISVILLE, KY.—Extensions and improvements contemplated by the Louisville Gas & Electric Company during 1925, include the installation of a 33,500-hp. turbo-generator with auxiliary equipment, new 4,000-volt switching equipment at its Waterside plant and also new switching equipment for station auxiliaries.

CANNELTON, IND.—The Lehman Company of America, Inc., plans to install electric power equipment in its proposed furniture manufacturing plant, to cost about $200,000. The Forest Products Engineering Company, 431 South Dearborn Street, Chicago, is engineer.

MADISON, IND.—Improvements are contemplated by the Madison Light & Power Company to its local distributing system. The company is controlled by the Louisville (Ky.) Gas & Electric Company.

VINCENNES, IND.—The Indiana Power Company plans to make extensions and improvements in its power plant, including the installation of additional equipment, to cost $330,400.

CAMARGO, ILL.—Application has been made by the Central Illinois Public Service Company, Springfield, to the Commerce Commission for authority to erect an electric distribution system in Camargo. It is proposed to erect a 6,000-volt line to Tuscola to connect with the transmission system there.

CHICAGO, ILL. — The Commonwealth Edison Company has filed plans for the construction of an addition to its substation at 4716-18 Prairie Avenue.

ROCKFORD, ILL.—The Rockford Electric Company has petitioned the Commerce Commission for permission to erect an electric line from Camp Grant, to New Milford.

FOND DU LAC, WIS.—Plans are under consideration for replacing the present five-lamp clusters in the downtown section with standards mounted with single lamps.

NEENAH, WIS.—The installation of an ornamental lighting system covering the entire business district is under consideration by the City Planning Commission.

PRINCETON, WIS. — Option has been taken on the property of the Princeton Power & Light Company by the Wisconsin Power & Light Company, Madison. If taken over the Wisconsin company proposes to erect a transmission line from the north side to the south side of Green Lake, then west to connect with the Princeton system to establish a 24-hour service here. It will also furnish electricity to several rural communities in this vicinity.

BRAINERD, MINN.—Bids, it is understood, will soon be asked for the installation of a new street-lighting system. The present plans call for 192 new lamp posts and for remodeling 85 old lamp posts. Louis P. Wolff, Globe Building, St. Paul, is engineer.

HARLAN, IOWA. — Improvements, to cost about $20,000, are contemplated to the municipal electric light plant, including rebuilding the distribution lines.

LEWIS, IOWA.—The Iowa Service Company, Omaha, Neb., plans to erect a 33,000-volt transmission line from Red Oak to Lewis, via Elliott and Griswold.

UNDERWOOD, IOWA. — Bonds to the amount of $5,000 voted for extensions and improvements in the electric light and power system.

GLASGOW, MO.—Plans are being considered by the Kansas City (Mo.) Power & Light Company for improvements to its local plant.

LA PLATA, MO.—The Mexico Power & Light Company, Mexico, has been granted permission to erect a 33,000-volt transmission line from La Plata to Atlanta, and also to erect and operate either single or three phase, 2,300-volt distribution line from this to serve farmers in that vicinity.

WELLSVILLE, MO. — Permission has been granted the Mexico Power & Light Company, Mexico, to erect and operate a 16,000-volt transmission line from Wellsville to Middletown.

DALTON, NEB. — The Western Public Service Company, Colorado Springs, Col., is negotiating for the purchase of the municipal power plant, and plans to extend its transmission line from Scotts Bluff for local service.

GREELEY, NEB.—The Western Public Service Company, Colorado Springs, Col., is negotiating for the purchase of the municipal electric plant. It plans to erect a transmission line for local service.

NAPOLEON, N. D.—The City Council is considering a proposition for a transmission line for commercial service from the Otter Tail Power Company, Fergus Falls, Minn.

Southern States

BREVARD, N. C.—The Cascade Power Company, which operates a hydro-electric plant on the Little River, contemplates doubling the output of its plant.

CHIMNEY ROCK, N. C.—The contract for the construction of the Lake Lure dam and power plant at Chimney Rock has been re-awarded to the Dunavant Gunter Company and the E. H. Clement Company, Charlotte, joint bidders, by the Chimney Rock Mountains, Inc. The total cost of the dam and power plant is estimated at $700,000.

DAVISBORO, GA. — Bonds have been approved for $15,000, for the installation of a municipal electric lighting system.

BRADENTON, FLA.—The installation of an ornamental lighting system on the Bradenton-Sarasota Road is under consideration. E. H. Price, Sarasota, is at the head of the movement.

COCOA, FLA. — The Cocoa-Rockledge Land Company plans to install an electric light and power system on a tract of 40,000 acres of land, to be laid out and developed for farming service.

TAMPA, FLA.—The City Commission has authorized a contract awarded to the Tampa Electric Company for the installation of a street-lighting system and to supply power for all of Seminole Heights. The contract calls for 126 lamps of 250 cp., mounted on ornamental posts, maintained by underground wires.

HUNTSVILLE, ALA. — The Alabama Power Company, Birmingham, has acquired a local site on which it proposes to erect a substation, to cost about $60,000.

NASHVILLE, TENN.—Improvements are contemplated by the Nashville Railway & Light Company during 1925, involving an expenditure of about $1,000,000. The work will include transmission line extensions, etc.

SMITHVILLE, TENN. — The Tennessee Electric Power Company, Chattanooga, has acquired the local electric light and power plant, and plans extensions in its transmission system in this section.

SHREVEPORT, LA.—The Summer Grove Utility Company is planning to erect a transmission line for service in the summer grove section. J. Pugh Wilkinson is president.

CLEBURNE, TEX.—The Gulf, Colorado & Santa Fe Railway Company, Galveston, Tex., plans to install electric power equipment in connection with proposed additions to its local shops, to cost about $250,000. F. Merritt is chief engineer.

ORANGE, TEX.—The Orange Ice, Light & Water Company contemplates extending its electric transmission system to furnish electricity for operating irrigation pumping plants in southeastern Louisiana.

PORT ARTHUR, TEX. — The Eastern Texas Electric Company plans to install an ornamental lighting system in the business district, using cast iron standards and 600-cp. lamps.

VICTORIA, TEX.—The Council is considering calling an election to vote on the proposal to issue $65,000 in bonds to establish a municipal electric plant. Bonds to the amount of $30,000 have been authorized, making the total $95,000.

WHITESBORO, TEX.—The City Council plans to install a 300-hp. oil engine with electric generator and exciter in the municipal electric plant.

Pacific and Mountain States

SEATTLE, WASH. — The Puget Sound Power & Light Company has taken out a permit to construct a 12,000-kw. substation on East Pine Street, near Twenty-second Street.

YALE, WASH.—The Northwestern Electric Company, Portland, Ore., it is reported, will ask for bids about May 1, for a hydro-electric project on the Lewis River, near Yale, to develop about 40,000 hp. About $1,500,000 will be expended during 1925. The total cost is estimated at about $5,000,000.

ALBANY, ORE. — Among the improvements contemplated by the Mountain States Power Company during 1925 is the erection of a new 66,000-volt transmission line between Albany and Springfield, via Corvallis, and from Independen to Salem, with necessary switching facilities at terminals, and intermediate points.

PORTLAND, ORE. — Plans are under way by the Pacific Telephone & Telegraph Company, Portland, involving an expenditure of $3,000,000 during 1925, for extensions and improvements to its lines and buildings, including rebuilding the distribution line from the California line to Seattle, Wash., and a new distribution line from Portland to Tallamook and from Eugene to Klamath Falls, also for improvements in principal cities of Oregon.

PORTLAND, ORE.—Extensions and improvements are contemplated by the Portland Electric Company during 1925, to cost about $2,000,000. The work will include the erection of a 60,000-volt transmission line from Oregon City to Salem, via Newburg, involving the reconstruction of 20 miles of the present line between Oregon City and Newburg and the building of a new line from there to Salem, and the erection of the second circuit from the new Oak Grove plant to Cazadero, a distance of about 18 miles. This line will be erected on steel towers, and though spaced for 115,000 volts, will be operated for the present at 60,000 volts. Also a new subway from Station "L" to Sullivan's Gulch in Portland, a distance of about 6,500 ft. In this subway will be laid two 11,000-volt cables and it is planned to continue this underground construction in future years from the Gulch to the Knott Street substation.

EMERYVILLE, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to erect a local substation, to cost about $125,000.

LOS ANGELES, CAL. — The Appleton Land, Water & Power Company, 604 Wash-

ington Building, has applied to the State Water Bureau for permission to build a hydro-electric power plant on Deep Creek, a tributory of the Mojave River, San Bernardino County, to cost about $400,000.

NAPA, CAL.—The City Council has authorized the installation of an ornamental lighting system on Arcadian and Main Streets, using cast iron standards. H. Harrold is city engineer.

SANTA BARBARA, CAL.—Bonds to the amount $140,000 have been authorized for the construction of a hydro-electric plant and electric distribution system.

STOCKTON, CAL.—The Stockton Electric Railroad Company has been granted permission to extend its car line on East Main Street, the work to include feeder lines, additional susbtation equipment, etc.

WHITTIER, CAL.—The City Council has authorized the installation of an ornamental lighting system on Comstock Avenue, using pressed steel standards.

SALT LAKE CITY, UTAH.—Work will soon begin on the construction of a hydro-electric plant by the Utah Power & Light Company on the Cutler site on the Bear River, 17 miles northwest of Logan. The plans call for a development of 30,000 kw., which will be transmitted to the company's terminal substation, 7 miles west of Salt Lake City, at 130,000 volts over a new transmission line, 80 miles long. A steel-pipe line 1,100 ft. long and 18 ft. in diameter will carry the water to the penstocks. The Phoenix Utility Company will have charge of the construction work.

CHINOOK, MONT.—The Montana Power Company, Great Falls, contemplates erecting a transmission line from Harlem to Chinook.

INGOMAR, MONT.—The City Council is considering the purchase of a local electric power plant, to be owned and operated by the municipality. Extensions and betterments are contemplated.

TROY, MONT.—Plans have been prepared by the Great Northern Railway Company, St. Paul, Minn., for a power house at its local shops.

PUEBLO, COL.—Extensions and improvements are contemplated by the Southern Colorado Power Company during 1925 to include the erection of a 60,000-volt transmission line between Pueblo and Canon City, with necessary susbtation facilities. Extensive improvements will be made to the transmission lines in the La Junta-Rocky Ford district.

Canada

CARDSTON, ALTA.—A hydro-electric project consisting of developing the water power of Belly River, at a cost of $82,000, is under consideration. It is proposed to supply electricity to towns in southern Alberta. C. B. Cheeseman is member of the local light committee.

TORONTO, ONT.—Budget figures for the Ontario Hydro-Electric Power Commission provide for an expenditure of eighteen to twenty millions dollars in the near future. Official estimates of the province for the fiscal year ending Oct. 31, 1925, include the following items: Niagara System: $13,500,000; for developing and improving Queenstown-Chippawa development, $7,500,000; transformer stations for Queenstown, $800,000; high-voltage stations in Guelph, Preston, Stratford, Woodstock, Kent and Essex, $1,000,000; transmission lines, $2,500,000; rural lines, $500,000; miscellaneous expenditures, $500,000. Georgian Bay System: $1,130,000; for extending South Falls Development, $40,000; power development on Muskosh River, $550,000; improving Severn, Eugenia and Wasdells systems, $30,000; transformer stations, $100,000; transmission lines, $230,000. St. Lawrence System: Development at Morrisburg, $1,500,000; transformer stations, $50,000; transmission lines, $100,000. Rideau System: General improvements $100,000. Thunder Bay System: Completion of units Nos. 3 and 4 and improvements to units Nos. 5 and 6 at Cameron's Falls and completion of dam at Virgin Falls, $1,700,000; transformer stations, $250,000; double-circuit steel-tower lines to Port Arthur and Fort William, $500,000. Central Ontario System: Crow River storage, $350,000; dams Nos. 4 and 5, $400,000; transformer stations, $100,000; transmission lines, $100,000; rural lines, $50,000; local systems, $200,000. Nipissing System: Cox's Chute, $100,000; transformer stations, $25,000, transmission lines, $20,000. Ottawa System: Developments on Ottawa River, $750,000, for miscellaneous improvements, etc. For betterments to general works of the commission, including service and administration buildings, etc., $500,000. F. Gaby is chief engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 24, 1925)

1,527,255. ELECTROMAGNETIC CLOCK; L. Hatot, Paris, France. App. filed Feb. 13, 1924.

1,527,259. PRINTING TELEGRAPHY; P. Lindet, Paris, France. App. filed Nov. 21, 1922.

1,527,292. HEATER; J. Barlow, Chicago, Ill. App. filed Oct. 28, 1922. For auxiliary use in connection with a heating plant.

1,527,305. ELECTRODEPOSITION OF METALS; T. W. S. Hutchins, Davenham, England. App. filed Feb. 5, 1923.

1,527,318. INSULATOR; Edwin Lewis, New York, N. Y. App. filed Aug. 10, 1921. Lead-in insulator attached to buildings.

1,527,332. INDUCTION MOTOR; R. Rudenberg, Charlottenburg, Germany. App. filed May 11, 1917. With an effective resistance loss produced in the rotor by means of the leakage fields in the rotor, which loss rises as the slip increases so as to obtain the full or nearly the full torque of the motor at speeds which differ considerably from synchronism.

1,527,343. PLUG RECEPTACLE; R. B. Benjamin, Chicago, Ill. App. filed Sept. 2, 1920.

1,527,345. ELECTRICAL TESTING DEVICE; B. H. Birchall, Highland Park, Pa. App. filed June 1, 1921. For determining the existence and location of electrical unbalances in signaling circuits.

1,527,346. FLEXIBLE INSULATOR; W. P. Brady, New Britain, Conn. App. filed May 29, 1922.

1,527,363. ELECTRIC HEATER; A. J. Kercher, Berkeley, Cal., and W. W. Hicks, San Francisco, Cal. App. filed April 9, 1923. Air heater for room or compartment.

1,527,400. CABLE TAP; C. S. Frankel, New York, N. Y. App. filed Dec. 8, 1923.

1,527,425. ELECTRICAL MEASURING EQUIPMENT; J. H. Miller, Oak Park, Ill. App. filed Aug. 12, 1922. For wireless receiving circuits employing a plurality of audions for conveniently and accurately measuring the current flow through the filaments of the audions.

1,527,426. STORAGE BATTERY; T. R. Cook, East Cleveland, Ohio. App. filed May 11, 1918.

1,527,430. GAUGE; W. N. Frank, Dayton, Ohio. App. filed Feb. 12, 1923. For indicating the height of liquids in containers.

1,527,433, 1,527,434. AUTOMATIC TELEPHONE SWITCH; T. Lenaghan, Croydon, England. App. filed June 12, 1922.

1,527,483. CURRENT-INTERRUPTING DEVICE FOR ELECTRICALLY HEATED WATER-DISTRIBUTING APPARATUS; J. Istas, Brussels, Belgium. App. filed Dec. 27, 1923.

1,527,526. ELECTROLYTIC PROCESS AND APPARATUS FOR THE EXTRACTION OF METALS; R. Rodrian, New York, N. Y. App. filed Nov. 10, 1922.

1,527,553. ALTERATING-CURRENT GENERATOR; L. F. Howard, Edgewood Borough, Pa. App. filed Feb. 28, 1923. Inductor type.

1,527,576. PROCESS OF COATING CONDUCTING MATERIALS WITH TIN; I. M. Scott and S. Peacock, Wheeling, W. Va., and W. E. Armstrong, Martins Ferry, Ohio. App. filed Feb. 19, 1923.

1,527,577. ELECTROPLATING BATH; I. M. Scott and S. Peacock, Wheeling, W. Va., and W. E. Armstrong. Martins Ferry, Ohio. App. filed Feb. 19, 1923.

1,527,612. TELEPHONE SYSTEM; S. Suekoff, Chicago, Ill. App. filed Jan. 6, 1921. Automatic selecting system.

1,527,623. PROTECTIVE DEVICE; J. Biermanns, Karlshorst, Germany. App. filed May 11, 1923. Relay.

1,527,636. REVERSING MOTOR CONTROL; J. Eaton, Schenectady, N. Y. App. filed April 25, 1922.

1,527,637. SEGREGATED DRIVE FOR PAPER-MAKING MACHINES AND THE LIKE; C. W. Fick, Schenectady, N. Y. App. filed July 12, 1922.

1,527,641. DYNAMO-ELECTRIC MACHINE PROTECTIVE SYSTEM; C. M. Gilt, Schenectady, N. Y. App. filed June 14, 1922. For protecting direct current generators against overload and flashover in case of short circuit without the use of circuit breakers or similar apparatus.

1,527,643. SYSTEM OF ELECTRIC SHIP PROPULSION; F. A. Haigh, Rugby, England. App. filed July 17, 1923.

1,527,644. CURRENT METER; C. I. Hall, Fort Wayne, Ind. App. filed Jan. 20, 1922. Maximum-demand type for installation in a manhole.

1,527,645. THERMAL RESPONSIVE SWITCH; C. I. Hall, Fort Wayne, Ind. App. filed Jan. 8, 1923.

1,527,646. SPEED-REGULATING SYSTEM; C. W. Hansell, New York, N. Y. App. filed March 26, 1924. For an alternating-current generator.

1,527,649. TELEPHONY; C. A. Hoxie, Schenectady, N. Y. App. filed May 20, 1921. Method and apparatus for transmitting sound.

1,527,651. CURRENT-WAVE REPEATER; Jacob S. Jammer, New York, N. Y. App. filed Sept. 19, 1919.

1,527,654. AMPLIFIER; E. W. Kellogg and F. Elder, Schenectady, N. Y. App. filed Dec. 21, 1920. Electron-discharge device.

1,527,655. OUTLET BOX; H. G. Knoderer, Bridgeport, Conn. App. filed Dec. 31, 1923.

1,527,660. INDUCTION MOTOR; Philip L. Alger, Schenectady, N. Y. App. filed Aug. 4, 1921. With double-wound rotor.

1,527,692. ELECTRIC HOT-WATER HEATING SYSTEM; W. L. Merrill, Schenectady, N. Y. App. filed Nov. 17, 1922.

1,527,703. ELECTRON-DISCHARGE APPARATUS; D. C. Prince, Schenectady, N. Y. App. filed April 8, 1922.

1,527,707. ELECTRICALLY HEATED LIQUID HEATER; S. Schneider, Hennigsdorf, Germany. App. filed Sept. 3, 1921.

1,527,709. ELECTRIC SWITCH; C. F. Schwennker, Schenectady, N. Y. App. filed March 30, 1922. Safety type.

1,527,725. SWITCHING MECHANISM; J. H. Wyatt, Kirklyn, Pa. App. filed Oct. 19, 1921. Multiple-throw switching mechanisms with interlocking means.

1,527,734. APPARATUS AND METHOD FOR ELECTROLYTICALLY DEPOSITING METALS; N. Huggins, New York, N. Y. App. filed Dec. 14, 1922.

1,527,744. CASCADE REGULATING SET FOR INDUCTION MOTORS; H. Meyer-Delius, Mannheim, Germany. App. filed March 6, 1922.

1,527,750. ELECTRIC SWITCH-OPERATING MEANS; J. Sachs, Hartford, Conn. App. filed Feb. 26, 1923. For facilitating the testing of meters in a protected service equipment.

1,527,761. ELECTRIC STEAM GENERATOR; H. L. Unland, Schenectady, N. Y. App. filed Dec. 16, 1922.

1,527,762. ELECTRIC STEAM BOILER; H. L. Unland, Schenectady, N. Y. App. filed April 7, 1923.

1,527,768. SHIP'S TELEGRAPH; T. P. Anning, Atco, N. J. App. filed Feb. 9, 1921.

1,527,790. CALL-DISTRIBUTING SYSTEM; W. T. Eastwood, Rochester, N. Y. App. filed Sept. 27, 1920. For telephone system.

1,527,797. PROCESS AND MACHINE FOR RIVETING CHAIN LINKS; F. H. Harrison, Chicago, Ill. App. filed Aug. 29, 1919.

1,527,804. CABLE BOX; J. Kunst, New York, N. Y., and H. L. Strongson, Brooklyn, N. Y. App. filed Sept. 22, 1921.

1,527,810. MAGNETIC SEPARATOR; R. A. Manegold, Milwaukee, Wis. App. filed Aug. 18, 1922.

1,527,820. AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed July 1, 1919.

1,527,888. INSULATOR FOR THE SUSPENSION OF LIVE CABLES FOR ELECTRIC RAILWAYS; A. Linde, Muckenberg, Germany. App. filed Nov. 6, 1924.

1,527,932. ALARM DEVICE FOR GYRO COMPASSES; E. A. Sperry, Brooklyn, N. Y. App. filed Aug. 11, 1917.

1,527,933. WIRELESS RELAY; L. C. Stasb, Leigh, Neb. App. filed Oct. 10, 1921.

1,527,959. PROCESS AND APPARATUS FOR MAKING SEATING MEMBERS FOR FLUID SEALS; C. F. Sherwood, San Francisco, Cal. App. filed Oct. 25, 1922. As copper-lined asbestos gaskets.

1,527,965. AUTOMATIC STAND FOR ELECTRIC IRONS; S. Sachs, Bronx, N. Y. App. filed Sept. 6, 1924. Automatically cuts off current when iron is placed on stand.

(Issued March 3, 1925)

16,012 (reissue). METHOD OF ELECTRIC ARC WELDING, CUTTING AND REPAIRING; C. J. Holslag, South Orange, N. J. App. filed Oct. 13, 1919.

16,013 (reissue). ELECTRIC HAIR WAVER; R. P. Simmons, Cleveland, Ohio. App. filed July 11, 1924.

16,015 (reissue). ELECTRIC HEATER FOR MOVING TOOLS; C. L. White, Medina, N. Y. App. filed May 14, 1924.

1,527,972. HANDLAMP; G. D. Gallagher, Washington, D. C. App. filed June 1, 1920. Flashlight.

1,528,000. BAKING WAFERS AND THE LIKE; R. G. Tugendhat, Brunn, Czechoslovakia. App. filed Aug. 1, 1924.

1,528,010. RADIO SIGNALING SYSTEM; C. S. Demarest, Ridgewood, N. J. App. filed Dec. 31, 1923. Radio system combined with a wire system.

1,528,011. RADIO SIGNALING SYSTEM; C. S. Demarest, Ridgewood, N. J., and M. L. Almquist, Brooklyn, N. Y. App. filed Dec. 31, 1293. For selectively signaling a particular station of such a system.

Financial and Corporate

Utility Stocks Steady

Irregular Movement During the Week Leaves Prices but Little Changed

A COMPILATION of the net price changes for the week ended March 16 reveals very few important variations. As a matter of fact the trading brought strength and then weakness at different periods of the week but in about equal degree. Probably the small advances outnumber the small declines. A sharp reaction in the general market for stocks listed on the New York Stock Exchange brought selling on Monday, but up to the time of going to press that selling had not greatly depressed the unlisted power and light stocks. General Electric stock fell over ten points on Monday alone.

Perhaps the outstanding development of the week was the great strength in Middle West Utilities Company's stock, which by advancing another eight points established a new high record at 103. The company's annual report recently published showed earnings of $14 per share on the stock, and since the announcement accumulation has been persistent. A still more spectacular advance, however, was that in American Water Works & Electric Company's stock on the big board. The company's stock sold last year as low as 40, but in the past week the new stock, which was given to holders of the old stock on the basis of five shares of new for one of old, sold above 40. Until last week the stock for some time has held around 36 or 37, but on Monday, following active accumulation for several days, the stock established a new high level at 45. A price of 45 for the new stock is equivalent to 225 for the stock that sold as low as 40 last year.

Among the lower-priced issues Electric Power & Light Corporation stock, following an announcement of the plan of distribution for Utah Securities Corporation, became very active. The Northern Ohio Power stock and options have had a better market in recent weeks, the stock selling at a new high price of 7½ and the options above 6. Trading during recent sessions has been only moderately active and has not revealed many new developments.

American Gas May Merge with U. G. I.

The board of directors of the American Gas Company and the United Gas Improvement Company at meetings recently held agreed to recommend to their stockholders a plan for the acquisition by the United of at least 75 per cent of the capital stock of the American Gas Company. The American Gas owns the Philadelphia Suburban Gas & Electric Company, which adjoins U. G. I. territory, and other smaller properties in various parts of the country. According to the proposed plan, the stockholders of the American Gas Company will be offered the right to exchange their stock on the basis of one share of $100 par for two shares of $50 par of stock in a Pennsylvania corporation to be organized. The Pennsylvania corporation will then be merged under the laws of Pennsylvania with the United Gas Improvement Company on the basis of one share of United for one share of such Pennsylvania corporation stock. In order to restore to the stockholders dividends deferred during the war period, the American Gas Company has declared a stock dividend in the amount of 22½ per cent and the United Gas Improvement will pay a 3 per cent extra cash dividend on the outstanding common stock. After the payment of this extra dividend and prior to the merger both the common and preferred stockholders of the U. G. I. will be given the right to subscribe to new common stock at $50 per share.

New Public Utility Group Organized

Electric Power & Light Corporation Is to Acquire the Assets of Utah Securities Corporation and Securities of New Orleans, Dallas and Idaho Companies

THE Electric Power & Light Corporation is the name of a new company incorporated in Maine to take over the assets of the Utah Securities Corporation, which includes all the common stock of the Utah Power & Light Company, as well as the common stocks and certain other securities—which are now owned by the Electric Bond & Share Company—of the New Orleans Public Service, Inc., the Dallas Power & Light Company, the Dallas Railway Company, the Texas Interurban Railway and the Power Securities Corporation, the latter company owning the common stock and certain other securities of the Idaho Power Company. The new company has been organized for the purpose of vesting in it the assets of the Utah Securities Corporation and certain equities in the other utilities which have been acquired by the Electric Bond & Share Company from time to time in the past. It will be possible through the new company to accomplish a broad and economical financing and development of these properties and to strengthen their credit and widen the market for future security issues through the geographical, industrial and climatic diversity afforded by the new company.

The corporation will have an authorized capital stock consisting of 500,000 shares of cumulative $7-per-share non-par, voting preferred stock, 120,000 shares cumulative $7-per-share non-par, non-voting second preferred stock and 2,400,000 shares of non-par, voting common stock. As announced elsewhere in this issue, 400,000 shares of the 7 per cent cumulative preferred stock were offered to the public during the past week.

Under the provisions of the plan the Utah Securities Corporation will distribute to the holder of each share of its capital stock $10 in cash plus four shares of common stock of the Electric Power & Light Corporation. The directors of the Utah Securities Corporation approved this plan, subject to confirmation by stockholders. A special meeting of the stockholders of the Utah Securities Corporation has been called for the purpose of acting upon the plan.

The gross earnings of the operating subsidiaries for the calendar year 1924 were in excess of $35,750,000. The companies whose equities will be held by the Electric Power & Light Corporation supply public utility service directly or indirectly in 253 communities, of which 245 are supplied with electric power and light service. Among the principal cities served are New Orleans, Dallas; Salt Lake City and Ogden, Utah; Durango and Montrose, Colo., and Boise, Pocatello and Idaho Falls, Idaho. The total population served is estimated at 1,179,000. Included in the property now owned and operated are electric generating plants having an installed generating capacity of 388,000 kw.

New Capital Issues

During the past week the Electric Power & Light Corporation, discussed at length elsewhere in this issue, floated through Bonbright & Company 400,000 shares of cumulative preferred stock, which were offered the public on a basis of 40 per cent down and the balance in installments of not more than 10 per cent of the subscription price. The financing involves a total of $40,000,000, the price being $100 per share. The proceeds from the initial payment of $40 a share on this preferred stock and from the sale of 120,000 shares of second preferred stock, together with the issuance of common stock, will be used by the corporation for the acquisition on an advantageous basis of the assets and securities concerned. The 400,000 shares were sold within forty minutes. An interesting feature of the week's financing was another foreign loan — the five-million-dollar-issue of first mortgage sinking-fund gold bonds of the Electric Power Corporation (Elektrowerke Aktiengesellschaft), Germany. The Electric Power Corporation is the largest producer of electric power in Europe, supplying energy within a ter-

ritory having a population of more than 16,000,000, approximately one-quarter of the entire population of Germany. These bonds, a direct obligation of the company, were priced at 87 and interest yielding over 7.67 per cent to maturity. Other sizable issues were the fifteen-million-dollar offering of the Niagara, Lockport & Ontario Power Company in the form of first mortgage and refunding 5 per cent gold bonds priced at 98½ and interest to yield about 5.10 per cent and the eleven-and-a-half-million-dollar issue of the Jersey Central Power & Light Company in first mortgage and refunding gold bonds offered at 97½ and accrued interest, yielding over 5.70 per cent.

The National Public Service Corporation offered thirty-year 6½ per cent collateral trust gold bonds totaling $6,000,000. These bonds constitute the only funded debt of the corporation. A issue of 6 per cent secured gold bonds totaling $3,750,000 represented the first piece of financing done by the recently organized National Electric Power Company. The bonds, priced at 97 and interest to yield 6.25 per cent, were dated March 1, 1925, and are due March 1, 1945. During the week public offering was made of 20,000 shares of additional 6 per cent cumulative preferred stock of the Cleveland Electric Illuminating Company dated March 1, 1925, and are due

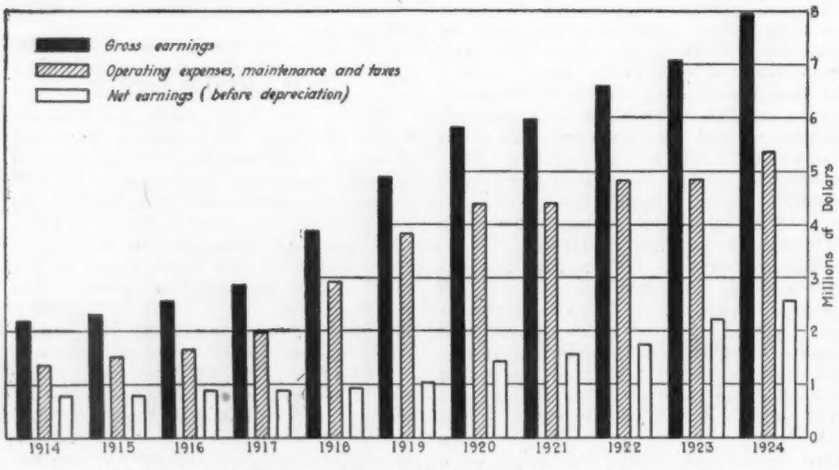
Simplification of the Capital Set-Up

How Oklahoma Gas & Electric Company Recently Has, by Creating a Mortgage of Modern Design, Greatly Improved Its Position

BY PAUL WILLARD GARRETT

THE Oklahoma Gas & Electric Company has, through the creation of a new mortgage and the sale of fresh bonds, arranged to retire its entire funded debt now outstanding. Ten different issues of bonds appear on the list at the present time, obligations bearing coupons with rates as high as 8 and 7½ per cent being among the lot. Sales of bonds during periods of tight money and before the company had reached its earning stride were responsible for these higher rates. The company now proposes to redeem all of its mortgage obligations and to that end already has, through its bankers, retailed an issue of $23,500,000 of first mortgage bonds due in 1950. What an unusual piece of financing the company has arranged and what benefits it will bring to the company are suggested by the fact that the new bonds bear a 5 per cent coupon, the bonds having been sold at 95, or to yield 5.36 per cent to maturity.

A substantial initial saving in annual interest charges will be realized through the substitution of the low for the higher coupon bonds, of course, but the greater gain lies in the fact that the Oklahoma Gas & Electric Company now has a mortgage of modern design that will permit it for an indefinite period into the future to finance on a favorable basis. By retiring the funded debt of such subsidiaries as Southern Oklahoma Power Company, Shawnee Gas & Electric Company and the Oklahoma General Power Company, as well as its own debt, the Oklahoma Gas & Electric Company is able to make the new bonds a first lien on all fixed properties in the entire system. After giving effect to the present financing, the $23,500,000 of first mortgage bonds will be a first lien on all properties of the company and that now owned by the subsidiaries and, except for an eight-million-dollar issue of 6 per cent debentures, will constitute the sole funded debt.



EARNINGS OF OKLAHOMA GAS & ELECTRIC COMPANY HAVE GROWN CONSISTENTLY SINCE 1914

Incorporated in 1902, this company, which is under the management of the Byllesby Engineering & Management Corporation, has in more recent years had a remarkable growth. In a state that has grown by leaps and bounds it now is the largest utility of its kind. It serves eighty-eight communities, including such places as Oklahoma City, El Reno, Enid, Drumright, Sapulpa and Muskogee. Gross earnings have had a steady rise from $2,197,549 in 1914 to $7,963,683. The number of electric customers has increased yearly from 32,014 in 1918 to 64,573 in 1924. Net earnings before depreciation grew from $800,834 in 1914 to $2,578,813 in 1924 and for the twelve months ended January 31, 1925, were $2,652,663. Annual interest requirements on the $23,500,000 of first mortgage 5 per cent bonds presently to be outstanding will be $1,175,000, or less than half the amount available during the past year for fixed charges.

Heretofore the two outstanding problems in connection with the company's development have been the lack of adequate generating facilities and the high interest rates. Through extensive improvements made in recent years the company has overcome its first problem and the present financing overcomes the second. The company now has a generating capacity in excess of its present peak loads and is able to take on a substantial volume of new business without making any further increases to its generating capacity. The Oklahoma Gas & Electric Company last fall completed the interconnection of its entire system with transmission lines. This interesting superpower system now extends to every community deriving service from the Oklahoma Gas & Electric System, including places as far apart as Enid, Oklahoma City, Tulsa, Fort Smith and Sulphur. More than 78 per cent of the present net earnings are derived from the sale of electric power and light, a significant thing to note in connection with a study on the past and future growth of the enterprise.

Utilities Responsible for 40 per Cent of 1924 Financing

Increasing confidence of the public in the future of electric, street-railway, telephone and gas companies is manifest in the tremendous volume of public utility securities purchased, says H. B. Dorau of the Institute for Research in Land Economics and Public Utilities. Mr. Dorau has just completed an analysis of public utility financing in 1924, in which he states that approximately 40 per cent of all corporate financing was done by the utilities.

"With few exceptions, all classes of utilities borrowed money at materially lower rates than in 1923," he says. "Utilities issued in excess of a billion dollars par value of securities in 1924, at an average yield per issue of 6.14 per cent on offering price. The average rates were materially lower in the last quarter of the year than in the first nine months."

Tables accompanying Mr. Dorau's analysis show the following simple average yields of all securities for the different branches of the industry: Electric light and power 6.24; gas and electric, 6.13; railway and electric, 6.14; electric railway, 6.04; water, 5.76; telephone and telegraph, 6.12 per cent; gas, 5.79.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the past week:

Name of Company	Per Cent	When Payable
American Gas & Electric, com.	25c	Apr. 1
American Gas & Elec., pf. (no par).	$1.50	May 1
American Gas & Elec., pf. ($50 par).	75c	May 1
American Power & Light, pf.	$1.50	Apr. 1
Asheville Power & Light, pf.	$1.75	Apr. 1
Birmingham Electric, pf.	$1.75	Apr. 1
Carolina Power & Light, com.	$1.50	May 1
Carolina Power & Light, pf.	$1.75	Apr 1
Central Illinois Light, 6% pf.	1½	Apr. 1
Central Illinois Light, 7% pf.	1¾	Apr. 1
Columbus Elec. & Pwr., com.	2½	Apr. 1
Columbus Elec. & Pwr., 1st and 2d pf.	1¾	Apr. 1
Columbus Ry., Pwr. & Lt. 1st pf. 6%	1½	Apr. 1
Electric Bond & Share Securities	25c	Apr. 15
Illinois Northern Utilities, pf.	$1.50	May 1
Illinois Power & Light, 7% pf.	1¾	Apr. 1
Illinois Power & Light, 6% pte. pf.	1½	Apr. 1
Kansas Gas & Electric, pf.	1¾	Apr. 1
Kentucky Securities, pf.	1½	Apr. 15
Kentucky Securities, com.	1½	Apr. 1
Long Island Lighting, pf.	1½	Apr. 1
Metropolitan Edison, pf.	$1.75	Apr. 1
Minnesota Power & Light, pf.	1¾	Apr. 1
Monongahela-West Penn Public Service, 6% pf.	37½c	Apr. 1
Monongahela-West Penn Public Service, 7% pf.	43¾c	Apr. 1
Mountain States Power, pf.	1¾	Apr. 20
Narragansett Electric Lighting	$1	Apr. 1
New York Central Elec. Corp., pf.	1¾	Apr. 1
Northern States Power, com. (a)	2	May 1
Northern States Power, pf.	1¾	Apr. 20
North American Lt. & Pwr., 7% pf.	1¾	Apr. 1
North West Utilities, prior l en pf.	$1.75	Apr. 1
Ottawa Lt., Ht. & Pwr., com.	1½	Mar. 31
Ottawa Lt., Ht. & Pwr., pf.	1½	Apr. 1
Pennsylvania Edison, pf.	$2	Apr. 1
Pennsylvania Power & Light, pf.	$1.75	Apr. 1
Quebec Power, pf.	1¼	Apr. 15
Savannah Electric & Power, pf.	2	Apr. 1
Springfield Ry. & Lt., pf.	1¾	Apr. 1
Standard Gas & Electric, com.	75c	Apr. 25
Standard Gas & Electric, 7% pr. pf.	1¾	Apr. 25
Toledo Edison, pr. pf.	2	Apr. 1
United Gas Improvement, com.	$1	Apr. 15
United Gas Improvement, pf.	87½c	June 15
United Light & Power, pf. A.	$1.63	Apr. 1
United Light & Power, pf. B.	$1.00	Apr. 1
United Lt. & Pwr., com. A and B.	45c	May 1
United Lt. & Pwr., com. A and B.	....*	May 1
United Light & Railways, 1st pf.	1¾	Apr. 1
United Light & Railways, pte. pf.	2	Apr. 1
United Light & Railways, com.	2	May 1
Western States Gas & Elec., pf.	1¾	Apr. 15
Yadkin River Power, pf.	$1.75	Apr. 1
Century Electric, com.	1½	Mar. 22
Century Electric, pf.	1¾	Apr. 1
Electric Storage Battery, com. & pf.	$1	Apr. 1

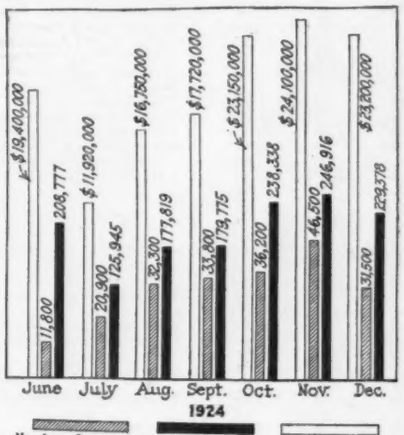
*One-fortieth share of class A common stock.

National Electric Power Company Organized

The National Electric Power Company is the new company formed to take over the control of the Cumberland County Power & Light Company, serving Portland, Me., and vicinity, and the Northwestern Public Service Company, serving a wide area in South Dakota. The company will own approximately 97½ per cent of the common stock of the Cumberland Company and all the common stock of the Northwestern Public Service. Albert Emanuel & Company of New York recently acquired the Maine property and in the last year and a half many small properties in the area served by the Northwestern Public Service Company, including ten small companies taken over recently, representing about 60 per cent of the total power generation facilities of South Dakota. The first financing done by the new holding company was in the form of an issue of twenty-year 6 per cent bonds totaling $3,750,000, to be followed shortly by an offering of $1,500,000 of 7 per cent cumulative preferred stock. In addition, there will be an issue of 10,000 shares of 7 per cent non-cumulative preferred stock, but this issue will not be publicly offered.

December Customer Stock Sales Total $23,200,000

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to customers and employees, it is estimated that during December a total of 229,378 shares were sold in this manner. The total value of this stock is estimated at $23,200,000 and 31,500 customers or employees bought it. The average sale to each such purchaser amounted to $737, an unusually high average.



DECEMBER STOCK SALES TO CUSTOMERS AVERAGED $737

During the seven-month period from June to December, for which data are available, a total of 1,406,948 shares has been sold under the customer-ownership plan. The value of this stock is estimated at $136,240,000 and it was sold to 213,000 customers or employees. There is a certain amount of duplication in the number of purchasers during the seven-month period which is impossible to eliminate with the data at hand. The average sale to each customer was $640.

Company Reports

Among the company reports issued during the past week for the month of January are the following:

Name of Company	Gross Revenues for January 1925	1924
Adirondack Power & Light*	$710,395	$628,781
Appalachian Power	324,360*	313,235
Eastern Shore Gas & Electric	68,782	53,163
Los Angeles Gas & Electric	2,003,107	1,631,740
Massachusetts Lighting	333,375	307,139
Mississippi Power & Light	147,908	116,426
New Bedford Gas & Edison Lt.	386,968	330,313
Pennsylvania Edison	275,026	283,872
Rutland Ry., Lt. & Pwr.	43,971	51,199
Sayre Electric	26,159	21,978
Utah Power & Light	881,203	848,953
West Penn	2,358,348	2,314,315

*February.

Electric Storage Battery Consolidated Statement.—For the year 1924 the Electric Storage Battery Company reported gross sales of $12,122,460 as compared with $11,836,030 for 1923 and operating profit of $6,501,528 against $6,606,861 the previous year. After crediting the income to the amount of $709,354, the company had a net income of $7,210,882 available for dividends against $7,216,522 in 1923. The net left, after federal taxes, a balance equal to $7.94 a share earned on the 799,173 shares of common and preferred outstanding. The general balance sheet showed profit and loss surplus of $20,540,378, subject to $863,000 in federal taxes, and cash holdings amounting to $2,954,112.

Manhattan Electric Reports Substantial Increase in Income.—The Manhattan Electric Supply Company for the year ended December 31, 1924, reported net income of $300,493 after expenses, depreciation, federal taxes, etc., equivalent to $4.29 a share earned on 70,000 shares of outstanding capital stock of no par value. These figures compare with a net of $94,177, or $1.34 a share, in the previous year.

Annual Report of the Worthington Pump & Machinery Corporation.—In the ninth annual report for the fiscal year ended December 31, 1924, the Worthington Pump & Machinery Corporation shows bookings amounting to $14,719,865 and billings amounting to $16,572,066. The unfilled orders at the close of the year amounted to $3,169,133. After deducting depreciation and all required reserves, the net income from operations was $1,347,779. After providing reserves for federal taxes and after payment of dividends on class A and class B preferred stock there was added to surplus from net income $166,981. The balance sheet shows current assets of $18,437,315, of which $1,342,912 is in cash, $3,286,529 in securities of the United States government and $84,742 in miscellaneous marketable securities.

Bonds Called in March.—Among the bonds of electric light and power companies called for payment in advance of maturity are the following: Winnipeg Electric Railway 6's, 1943, totaling $3,250,000; Hartford Electric Light 7's, 1930, totaling $3,000,000; Federal Light & Traction convertible 7's, 1953, totaling $2,407,000; Denver Gas & Electric 7½'s, 1946, totaling $1,184,000; Western Utilities 6's, 1927, totaling $104,000, and the Springdale Light & Power 6's, 1932, totaling $99,000.

Directors Vote for Split-Up.—At the recent annual meeting the directors of the Federal Light & Traction Company voted to split the common stock on a five-for-one basis, and the plan will be submitted for approval to the stockholders at a special meeting to be called April 28. The stockholders will also be asked to authorize the issuance of 155,000 shares of new no-par-value preferred stock to take the place of the present 6 per cent preferred and of an authorized issue of 8 per cent preferred which has never been issued. The authorized total of the 6 per cent preferred is 55,000 shares, of which 38,796 shares are outstanding. The new common to be issued in exchange for the present no-par shares will have a par value of $15 a share.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

Companies	Bid Price Saturday, March 14	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	99	98	101
Appalachian Power, 7 per cent	97½	92	100
Arkansas Light & Power 7 per cent	94	92	98
Asheville Power & Light 7 per cent	a 99	99	100
Central Illinois Public Service 6 per cent	84½	84	87
Colorado Power 7 per cent	93	93	98
Connecticut Light & Power 7 per cent	105	105	110
Consumers' Power 6 per cent	91½	90	93½
Dayton Power & Light 6 per cent	94	88	100
Duquesne Light 7 per cent	a107	105	107½
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	a101	100	102
Great Western Power 7 per cent	98	...	...
Illinois Northern Utilities 6 per cent	88	82	92
Illinois Power & Light 7 per cent	94½	92½	98
Kansas Gas & Electric 7 per cent	a 98	98	100
Long Island Lighting 7 per cent	101½	100	105
Minnesota Power & Light 7 per cent	a 96	96	98
Mississippi River Power 6 per cent	89	87½	91
Nebraska Power 7 per cent	a 98	98	100
Niagara Falls Power 7 per cent—25	28½	28	29
Niagara, Lockport & Ont. Power 7 per cent	106	101½	110
Northern States Power 7 per cent	97	95	100
Ohio Public Service 7 per cent	97½	97	100
Pacific Gas & Electric 6 per cent	95	92	97
Pacific Power & Light 7 per cent	a 99	99	100
Penn-Ohio Power & Light 7 per cent	93	91	100
Pennsylvania Power & Light $7—no par	a101	100	101½
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	41½	40	45
Southern California Edison 8 per cent	116	115	120
Tennessee Electric Power, 6 per cent	82	80	84
Texas Power & Light 7 per cent	a100	100	101
Utah Power & Light 7 per cent	a 99	99	100
Western States Gas & Electric 7 per cent	82	82	85
Yadkin River Power, 7 per cent	a 99	98	100
Holding Companies			
American Gas & Electric 6 per cent—50	44½	44	47½
American Light & Traction	93½	93	95½
American Power & Light 6 per cent	87½	86	90
American Public Service 7 per cent	87	87	92
American Public Utilities 7 per cent	87	87	95
American Water Works & Electric 7 per cent	a102¾	100	103
Associated Gas & Electric 7 per cent—1 per cent extra—50	a 49	...	...
Carolina Power & Light 7 per cent	101½	100	105
Central Indiana Power 7 per cent	88½	88	93
Cities Service 6 per cent	81	80	83
Commonwealth Power 6 per cent	80½	80	82½
Consolidated Gas 6 per cent—50	57½	57½	58½
Continental Gas & Electric 7 per cent pr. pf.	91	89	95
Electric Bond & Share 6 per cent	102½	102	103½
General Gas & Electric—$8—no par	107	104½	110
*Middle West Utilities 7 per cent	96½	91½	97⅞
National Power & Light—$7—no par	96	95	99
North American 6 per cent—50	a 48½	46¾	49
Public Service Corp. of N. J. 7 per cent	99	99	102
Public Service Corp. of N. J. 8 per cent	a110	109⅞	112½
Standard Gas & Electric 8 per cent—50	a 52	51½	53⅜
†United Gas Improvement—50	57	57	58½
United Light & Power—$6.50—no par	85	83	88
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	35	31	41
Appalachian Power—no par	76	70	83
Arkansas Light & Power	75	65	85
Brooklyn Edison	a129	120¾	133
Buffalo General Electric	240	197	245
Colorado Power	a 33	...	...
*Commonwealth Edison	137½	134½	139
§Consolidated Gas, Electric Light & Power	34½	32	35¼
Dayton Power & Light	420	180	460
Detroit Edison	a116¾	110	119
|| Edison Electric Illuminating of Boston	200	200	206
Kentucky Hydro-Electric	a 90¾	85¼	92½
Long Island Lighting	250	...	...
Mississippi River Power	37	37	40
Montana Power	a 67⅞	66½	72
Niagara Falls Power—no par	50	45⅛	58
Niagara, Lockport & Ontario Power—no par	63	63	73
Northern Ohio Power	6½	5	7½
Northern States Power	107	103	110
North Texas Electric	62	62	67
Pacific Gas & Electric	a106½	102½	108½
‡Penn Central Light & Power—no par	63½	60	64¼
§Pennsylvania Water & Power	130¼	126½	133½
‡Philadelphia Electric—25	42	40½	45⅝
Public Service Co. of Northern Illinois	114	97	116
Puget Sound Power & Light	51	51	58
Southern California Edison	103	102	106
Tennessee Electric Power—no par	54	47	61
Virginia Power	65	65	92
Virginia Railway & Power	a 78⅜	64½	86½
West Penn. Co.	a114	105	120
Holding Companies			
American Gas & Electric—no par	70	70	80
American Light & Traction	146	139	153
American Power & Light	55½	53	67
American Public Utilities	70	70	85
American Water Works & Electric	a 42¾	34⅜	45
Carolina Power & Light—no par	315	290	340
Cities Service	200	172	210
Columbia Gas & Electric—no par	a 54½	45¾	59
Commonwealth Power Corp.—no par	111	106	126
Consolidated Gas—no par	a 76	74⅜	78⅜
Continental Gas & Electric	87	80	90
Federal Light and Traction	a140	114½	148½
General Gas & Electric	76	72	81
Lehigh Power Securities—no par	97	82	116
*Middle West Utilities—no par	97	82½	98
National Power & Light—no par	217	185	230
North American—10	a 45⅞	41½	49
Philadelphia Co.—50	a 53	52⅞	57½
Power Securities—no par	16	...	...
Public Service Corp. of N. J.—no par	a 68⅝	67½	72½
Standard Gas & Electric—no par	a 45	40½	47½
United Gas & Electric (Conn.)—no par	31	26	37½
Utah Securities	a 66½	41⅛	69¼

Companies			Bid Price Saturday, March 14	Low 1925	High 1925
BONDS					
Operating Companies					
Adirondack Power & Light	6s	1950	104½	102½	105
Alabama Power	5s	1946	97	96	97½
Appalachian Power	5s	1941	97	96	97½
Brooklyn Edison	5s	1949	99⅞	99½	100⅛
	6s	1930	104½	104½	105
Cleveland Electric Illuminating	5s	1939	100½	100	101½
Commonwealth Edison	5s	1943	100½	99½	101
	5s	1953	99	98½	99½
Consol. Gas, Elec. Lt. & Pwr.	4½s	1935	95½	95½	96½
	6s	1949	105¾	104¾	106¼
Consumers' Power	5s	1936	99	99	99½
	5s	1952	94	90¾	95½
Detroit Edison	5s	1933	101½	100	102½
Duquesne Light	6s	1949	105½	105	107
Great Western Power	5s	1946	96½	95	97½
Kansas City Power & Light	5s	1952	98	95½	98
Mississippi River Power	5s	1951	98½	96½	99
Montana Power	5s	1943	99½	97½	99½
New England Power	5s	1951	100½	100½	101½
New York Edison	6½s	1941	113	112½	115
Niagara Falls Power	5s	1932	101½	100½	102½
Northern States Power	5s	1941	96½	93	96½
	6s	1941	104½	103	105½
Ohio Power	7s	1951	106½	106½	107½
Pacific Gas & Electric	5s	1942	94½	93½	96
§Pennsylvania Water & Power	5s	1940	100¼	100	100½
‡Philadelphia Electric	5s	1966	101	100½	102
	5½s	1947	105	103½	105
	6s	1941	107	106	107½
Portland Electric Power	6s	1947	98	94	99½
Southern California Edison	5s	1939	99½	99½	100
	6s	1944	103½	102½	104½
Tennessee Electric Power	6s	1947	102	99½	102½
Texas Power & Light	5s	1937	97½	97	98
Toledo Edison	7s	1941	109½	108½	110
Utah Power & Light	5s	1944	94½	91	95½
Holding Companies					
Alabama Traction, Light & Power	5s	1962	86	86	87½
American Gas & Electric	6s	2014	96½	96½	97
American Power & Light	6s	2016	95	94	95½
Amer. Water Works & Electric	5s	1934	95½	92½	96¼
Associated Gas & Electric	6½s	1954	a100	...	...
Central Indiana Power	6s	1947	98	95½	98½
Commonwealth Power	6s	1947	100½	97½	101
Consolidated Cities Lt., Pwr. & Tr.	5s	1962	79½	75½	80½
Illinois Power & Light	6s	1953	101½	100½	102
United Light & Railways	5s	1932	95	93½	95
	6s	1952	98	95¼	99

ELECTRICAL MANUFACTURING COMPANIES

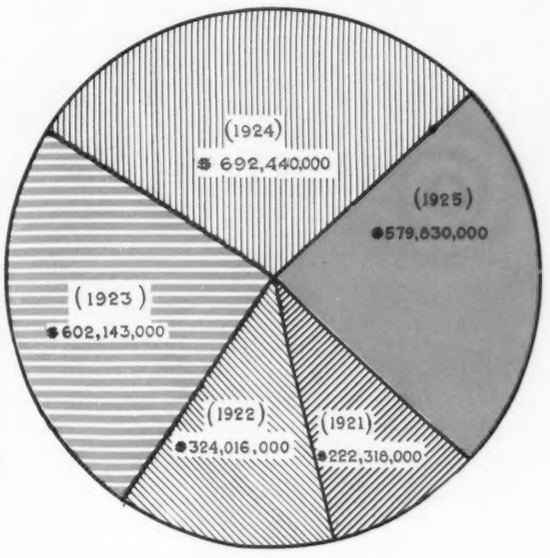
Companies			Bid Price Saturday, March 14	Low 1925	High 1925
PREFERRED STOCKS					
Allis-Chalmers Manufacturing			105	103½	107
*National Carbon			122	120	124
Worthington Pump & Machinery A			a 85	85	88
COMMON STOCKS					
Allis-Chalmers Manufacturing			a 82½	71½	86½
American Bosch Magneto—no par			a 31½	29½	54½
Electric Storage Battery—no par			a 64½	62½	70½
General Electric			a265	227½	320
General Electric—10			a 11½	11	11½
*Hurley Machine—no par			48	47	56
†Wagner Electric			36½	26½	50
Westinghouse Electric & Manufacturing—50			a 70	68½	84
Worthington Pump & Machinery			a 59⅞	55½	79¾
BONDS					
Canadian General Electric	6s	1942	107½	107½	107⅞
General Electric	3½s	1942	82⅛	82⅛	84
	5s	1952	103	101½	105½
Robbins & Myers	7s	1952	67	67	73½
Western Electric	5s	1944	98½	98	99½
Westinghouse Electric & Mfg.	7s	1931	107½	107½	108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡ Philadelphia Stock Exchange. || Boston Stock Exchange § Baltimore Stock Exchange.
a Bid price low and hgh, Tuesday, March 17.

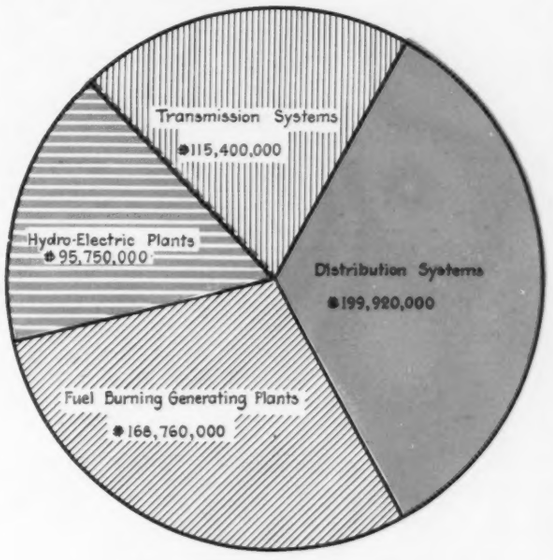
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Two and a Half Billion for Additions to Generating, Transmission and Distribution Systems in Five Years



Value of Extensions 1921-1925, Incl
$2,420,747,000



Segregation of 1925 Expenditures
$579,830,000

Central-Station Expansion Continuous

THE large amounts which the electric light and power companies of the country are spending annually for additions and extensions to their generating, transmission and distribution equipment exceed the ordinary man's sense of comprehension. One may feel at home juggling with hundreds of thousands or even millions, but when the quantities rise to hundreds of millions or even billions most normal men lose their sense of proportion.

The fact that during the past five years the electric light and power companies have spent approximately two and a half billion dollars for new equipment simply means to most men that the industry has recorded a very large growth, but the actual size of that growth is not made apparent. A clearer picture is presented to the average mind when certain comparisons are made. This amount spent by the electric light and power companies during the past five years is two and a half times the total state, county and municipal bond loans of 1923 and 80 per cent of the total loans made to all corporations during the same year. It is four times any congressional appropriation made for any year up to the time the United States entered the World War and almost three times the public debt of the United States in 1916. It is almost three times the value of the total wheat production of the country, one and one-quarter times the corn production, six times the oats production and over nine times the value of the potato production, all of these figures for the year 1922.

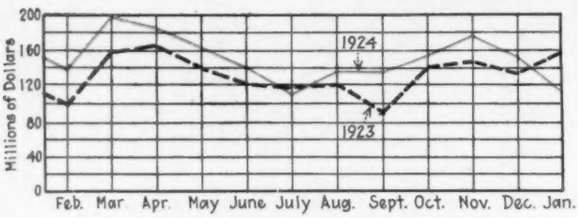
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

It is almost equal to the assessed valuation of the Borough of Manhattan in 1900.

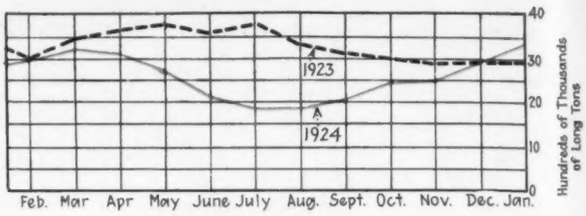
During the present year alone a total of $579,830,000 will be spent by electric light and power companies for expansion purposes—a sum equal to one-half the gross revenue of the industry during 1924. This sum is one and three-quarters times the estimated expenditures of the electric railways of the country, over twice the expenditures of the telephone industry and twice the amount which will be expended by the steam railroads for new equipment. One of the outstanding facts concerning the expenditures of the electric light and power companies, however, is that fully 90 per cent of this amount is to take care of future growth, and this is also largely true of the telephone industry. Among the older industries of the country, however, such as the steam railroads, the expenditures during the year will be very largely to take care of depreciation and obsolescence.

How the Primary Industries Are Trending

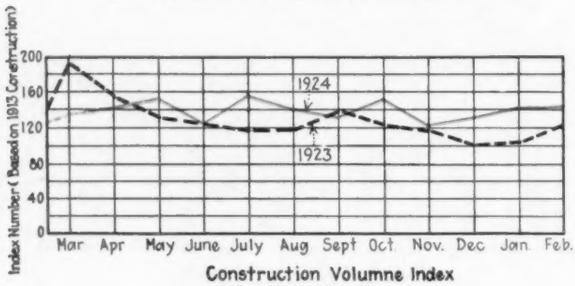
All data except that on "Volume of Construction" and "Construction Cost" are supplied monthly by the Bureau of the Census. Similar data on other industries may be obtained from the "Survey of Current Business," Bureau of the Census, Washington, D. C.



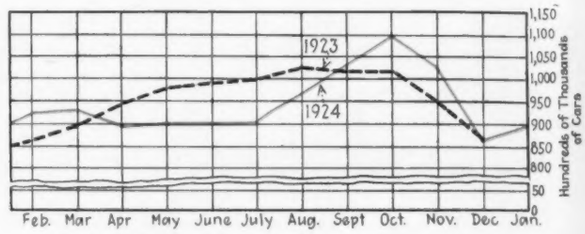
Contracts Awarded for Residential Buildings



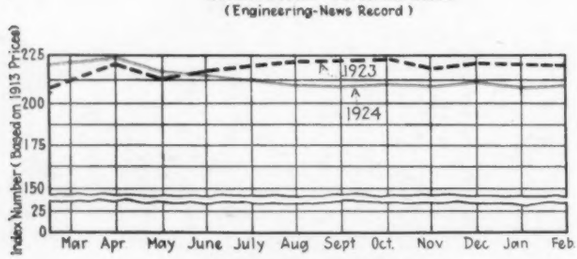
Pig-Iron Production



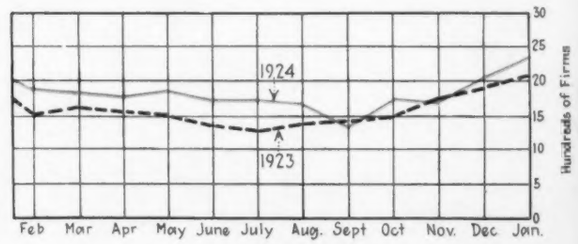
Construction Volumne Index
(Engineering-News Record)



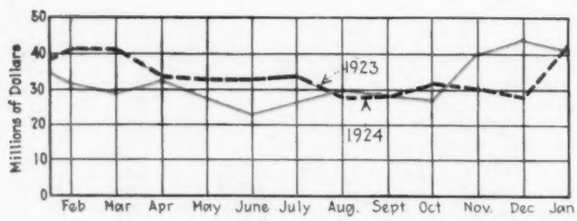
Total Average Weekly Freight-Car Loadings



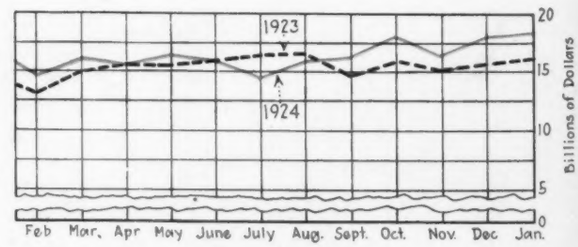
Construction Cost Index
(Engineering-News Record)



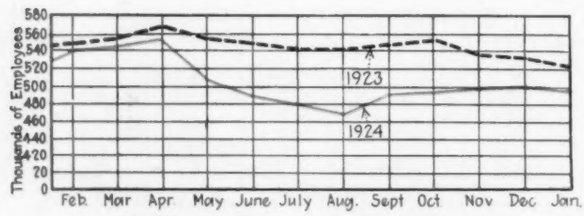
Business Failures



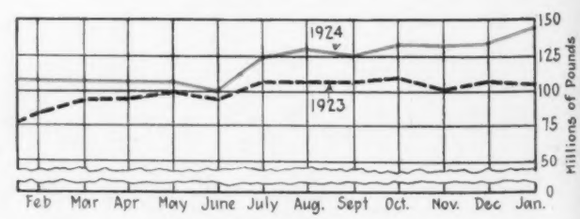
Fire Losses



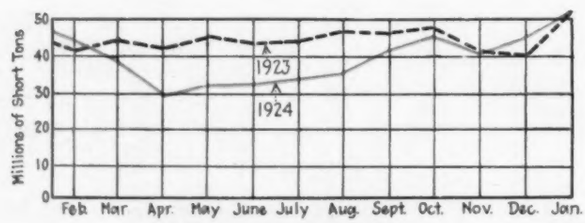
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Industrial Activity Increasing

INDUSTRY in general is still increasing in activity, but at a less rapid rate than was reported during December. January operations in most primary industries were above those reported for the same month of last year.